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USDA/TAES Toxicology Program Review

AAZ 676

USDA Agricultural Research Service

P 51

Veterinary Toxicology and Entomology Research Laboratory
College Station, Texas

Poisonous Plant Research Laboratory
Logan, Utah

Texas Agricultural Experiment Station

Veterinary Physiology and Pharmacology
College Station, Texas

College Vet Medicine
Room 2004
Vet. Sciences Bldg

Veterinary Public Health
College Station, Texas

Texas A&M University Research and Extension Center
San Angelo, Texas

Texas Veterinary Medical Diagnostic Laboratory
College Station, Texas

October 26-28, 1981

College Station, Texas

USDA/TAES TOXICOLOGY PROGRAM REVIEW

Table of Contents

AGENDA

USDA/TAES TOXICOLOGY PROGRAM REVIEW
October 25-28, 1981

Veterinary Toxicology & Entomology Research Laboratory, ARS/USDA
F&B Road
College Station, Texas

Monday, October 26, 1981

8:30 AM - 9:00 AM - Informal Meeting, Laboratory Director's Office, VTERL
Panel Members & Administrative Staff

Convene, VTERL Conference Room

9:00 AM - 9:15 AM - Welcome
J. R. Johnston & Neville P. Clarke

9:15 AM - 9:45 AM - Introduction of Reviewing Officials and Participants
H. Graham Purchase, Donald A. Witzel, & J. D. McCrady

9:45 AM - 10:00 AM - Purpose of Review & Procedures
H. Graham Purchase, Chairman

10:00 AM - 10:15 AM - Break

10:15 AM - 11:15 AM - Overview of Toxicology Programs
J. D. McCrady, K. R. Pierce, N. D. Heidelbaugh, C. S. Menzies, K. A. Eugster, L. F. James, D. A. Witzel, & Others as Appropriate

11:15 AM - 12:00 N - Tour VTERL Facilities
D. A. Witzel & Research Leaders

12:00 N - 1:30 PM - Lunch

Discussion of On-Going Programs by Discipline

1:30 PM - 3:00 PM - Veterinary Toxicology (In Vivo Toxicology)
L. D. Rowe, Chairman

3:00 PM - 3:15 PM - Break

3:15 PM - 5:00 PM - Toxic Plants
E. Murl Bailey & Lynn F. James, Co-Chairmen

MONDAY EVENING
6:30 PM - Social and Dinner at VTERL

Tuesday, October 27, 1981

8:30 AM - 9:30 AM	-	Mycotoxin (Feed/Food) Toxicology *T. D. Phillips & B. J. Camp, Co-Chairmen*
9:30 AM - 9:45 AM	-	Break
9:45 AM - 10:45 AM	-	Cellular (In Vitro) Toxicology *Hilton H. Mollenhauer, Chairman*
10:45 AM - 12:00 N	-	Environmental Toxicology *Stephen H. Safe, Chairman*
12:00 N - 1:30 PM	-	Lunch
1:30 PM - 3:30 PM	-	TAMU Research Training Programs in Toxicology
3:30 PM - 3:45 PM	-	Break
3:45 PM - 5:00 PM	-	Tour TAMU Facilities
TUESDAY EVENING	-	Executive Session, Review Panel *H. Graham Purchase, Chairman*

Wednesday, October 28, 1981

8:30 AM - 9:45 AM	-	Chemistry and Metabolism *Richard F. Keeler & G. W. Ivie, Co-Chairmen*
9:45 AM - 10:00 AM	-	Break
10:00 AM - 10:45 AM	-	Diagnostics in Veterinary Toxicology *John C. Reagor, Chairman*
10:45 AM - 12:00 N	-	Wrap-Up Discussion of Research Programs
12:00 N - 1:30 PM	-	Lunch
1:30 PM - 3:15 PM	-	Executive Session, Review Panel *H. Graham Purchase*
3:15 PM - 3:30 PM	-	Break
3:30 PM - 5:00 PM	-	Comments and Recommendations of Review Panel *H. Graham Purchase*
5:00 PM - 5:30 PM	-	Discussion
5:30 PM	-	Concluding Remarks
WEDNESDAY EVENING	-	Executive Session, Review Panel (Preliminary Draft of Report) *H. Graham Purchase*
		Adjourn

Tuesday, October 2[illegible], 19[illegible]

8:30 AM - 9:30 AM - Respiratory (Head/Lung) Pathology
[illegible]

9:30 AM - 9:45 AM - Break

9:45 AM - 10:45 AM - Cellular (In Vitro) Toxicology
[illegible], Chairman

10:45 AM - 12:00 N - Environmental Toxicology
[illegible], Chairman

12:00 N - 1:30 PM - Lunch

1:30 PM - 3:30 PM - NIH Research Training Programs in Toxicology

3:30 PM - 3:45 PM - Break

3:45 PM - 5:00 PM - Tour [illegible] Facilities

TUESDAY EVENING - Executive Session, Review Panel
Dr. Graham [illegible], Chairman

Wednesday, October 2[illegible], 19[illegible]

8:30 AM - 9:45 AM - Chemistry and Metabolism
[illegible]

9:45 AM - 10:00 AM - Break

10:00 AM - 10:45 AM - Diagnostics in Veterinary Toxicology
[illegible], Chairman

10:45 AM - 12:00 N - Wrap-Up Discussion of Research Programs

12:00 N - 1:00 PM - Lunch

1:00 PM - 3:15 PM - Executive Session, Review Panel
Dr. Graham [illegible]

3:15 PM - 3:30 PM - Break

3:30 PM - 5:00 PM - Comments and Recommendations of Review Panel
Dr. Graham [illegible]

5:00 PM - 5:30 PM - Discussion

5:30 PM - Concluding Remarks

WEDNESDAY EVENING - Executive Session, Review Panel (Preliminary Draft of Report)
Dr. Graham [illegible]

Adjourn

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HISTORY, SCOPE, AND OBJECTIVES

The Toxicology research program of the Agricultural Research Service, U.S. Department of Agriculture, was initiated in the late 1940's at the Livestock Insects Investigation Laboratory, Kerrville, Texas. During the 1950's, Texas A&M University expressed an interest in having the livestock and toxicology work of the Entomology Research Division and Animal Disease and Parasite Research Division (such as was then conducted at Kerrville, Texas) located at College Station. The University indicated that it would have no difficulty in providing land and that it would consider providing some of the facilities. Ultimately, Texas A&M deeded approximately 60 acres of land to ARS, of which 55 acres was devoted to the Veterinary Toxicology and Entomology Research Laboratory complex. The advantages of a major part of the USDA's livestock toxicology research effort being located near this land-grant University were many. The Veterinary Toxicology and Entomology Research Laboratory (VTERL) was authorized by Congress in 1964, and construction was completed in June, 1970.

Texas A&M University's research program in veterinary toxicology was established in the early 1950's to meet the needs of the Texas livestock industry. These needs were highlighted by poisonous range plants that were devastating to cattle and sheep. Since that time, the extensive use of agricultural chemicals and industrial expansion have led to additional toxicological problems. The Toxicology Section has expanded into one of the major teaching and research units within the College of Veterinary Medicine. The establishment of a cooperative research program at San Angelo, Texas, has helped to meet the requirements for continuous studies of poisonous plants by the Texas Agricultural Experiment Station. The Texas Veterinary Medical Diagnostic Laboratory, adjacent to the Texas A&M College of Veterinary Medicine

facilities, was opened in December 1969 and currently provides veterinary diagnostic toxicology on par with any in the nation.

The USDA Poisonous Plant Research Laboratory at Logan, Utah, has had roots in poisonous plant research for many decades. Research by the USDA on the effects of poisonous plants in livestock was initiated in 1905 at a temporary location in Colorado. Since then, poisonous plant research work by the USDA has been done in temporary locations in Colorado, Nebraska, Montana, and Utah. Many of the poisonous plants occurring in the U.S., particularly those in the western range states, were studied. These included locoweed, larkspur, death camas, lupine, tetradymia, hemlock, and sneezeweed. The research program was located at a permanent headquarters at Salina, Utah, for many years, and was later moved to Logan, Utah, around 1950. Since that time, the Poisonous Plant Research Laboratory has made major contributions to livestock management in the poisonous plant areas of the western United States.

The toxicology research programs documented here represent a joint federal-state endeavor (ARS and the TAMU system) to reduce livestock losses caused by toxic agents. Major research efforts have been directed toward poisonous plant research because of the widespread geographical distribution of and the economic losses caused by these plants in Texas and the western United States. The programs have been expanded in recent years into the areas of agricultural and environmental toxicants. In fact, the VTERL was established primarily to address research needs in these latter areas.

Included in this review are two ARS, USDA facilities, the Poisonous Plant Research Laboratory, Logan, Utah, and the VTERL at College Station, Texas. The state counterparts are represented by the Texas A&M University Research and Extension Center, San Angelo, Texas, the Texas Veterinary Medical Diagnostic Laboratory and the College of Veterinary Medicine, TAMU, College Station, Texas.

Each facility conducts independent research focused on projects of major toxicologic significance, yet there are cooperative activities among all groups involved. The close proximity of VTERL and TAMU has provided the opportunity to develop a strong program in toxicologic research and education.

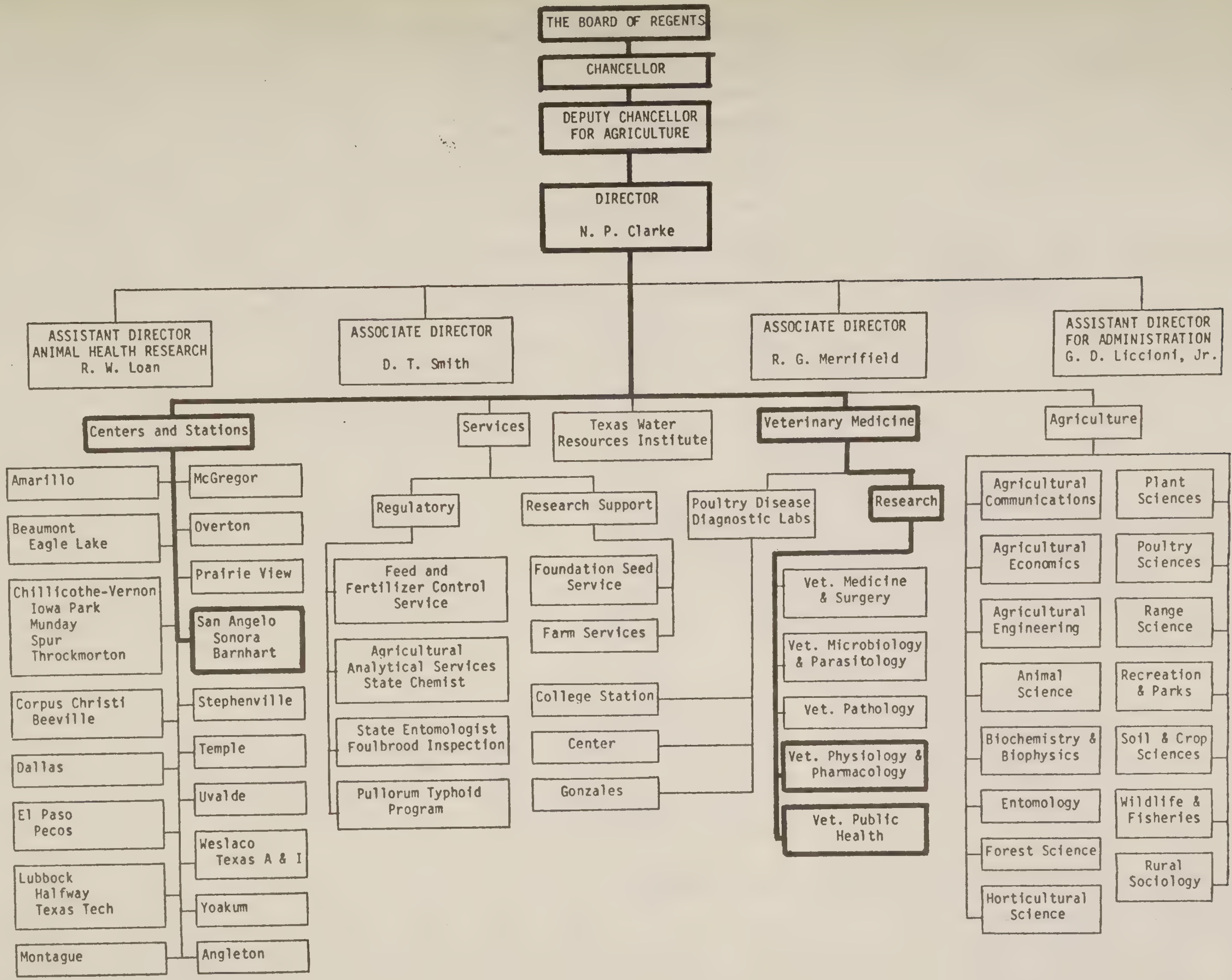
The objectives of this Toxicology Program Review are to:

1. Evaluate existing programs in Veterinary Toxicology within ARS and the Texas A&M University System, specifically regarding research priorities, technical adequacy, and training. Quality
2. Identify areas where cooperative efforts between these agencies will lead to more efficient utilization of expertise and resources, thus leading to increased research productivity. Clarify roles of federal & state players

   (a) Roles (b) Balance (c) examples of cooperation
3. Evaluate current research thrusts and priorities in light of projected research needs in Veterinary Toxicology and to add emphasis or re-direction to existing programs as required to better address future research objectives. Priorities
4. Provide research personnel with the opportunity for self-evaluation of their research priorities and directions so that their research programs can better address critical research needs in animal production and protection.
5. Allow an administrative assessment of the overall direction, progress, and priorities of the programs and to provide information to administrative personnel so that adequate scientific and physical resources can be provided to achieve these goals. Resource allocation

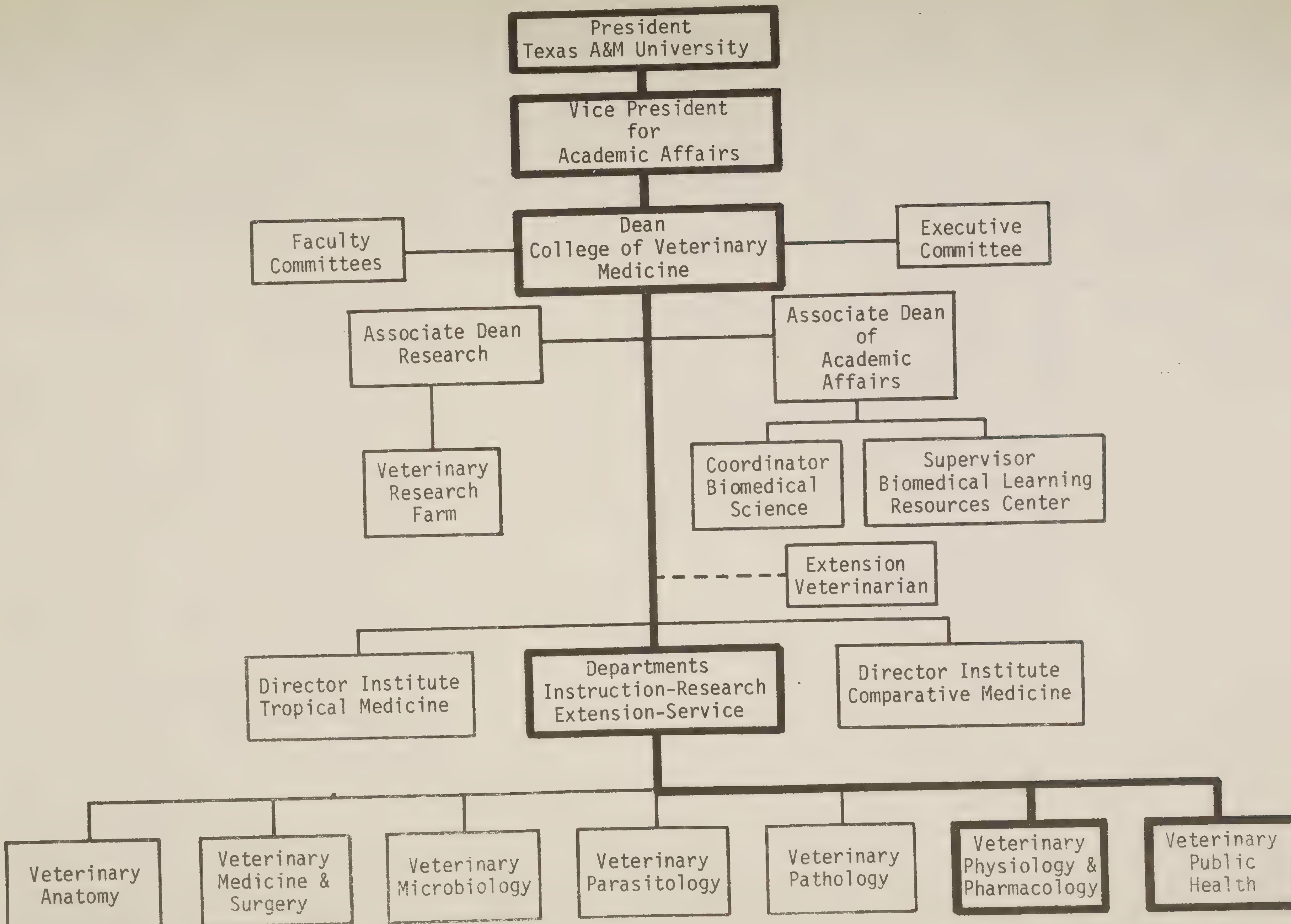
ORGANIZATIONAL STRUCTURE

THE TEXAS A&M UNIVERSITY SYSTEM
THE TEXAS AGRICULTURAL EXPERIMENT STATION



COLLEGE OF VETERINARY MEDICINE--TEXAS A&M UNIVERSITY

ORGANIZATIONAL STRUCTURE



DEPARTMENT OF VETERINARY PHYSIOLOGY AND PHARMACOLOGY--TEXAS A&M UNIVERSITY

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    - Eva Binford, Technician
    - Bruce Martin, Ernest Oertli, Postdoc Students (USDA Co-op)
    - Brent Herrig, Jeff Whall, Postdoc Students
    - Luci Hannsen, Merry Holmes, Grad Students (USDA Co-op)
    - Debbie Johns, Tracy Pajeski, Lori Schmidt, Lynn Post, Grad Students
  - Bennie J. Camp, Professor
    - Estelle Hejtmancik, Technician
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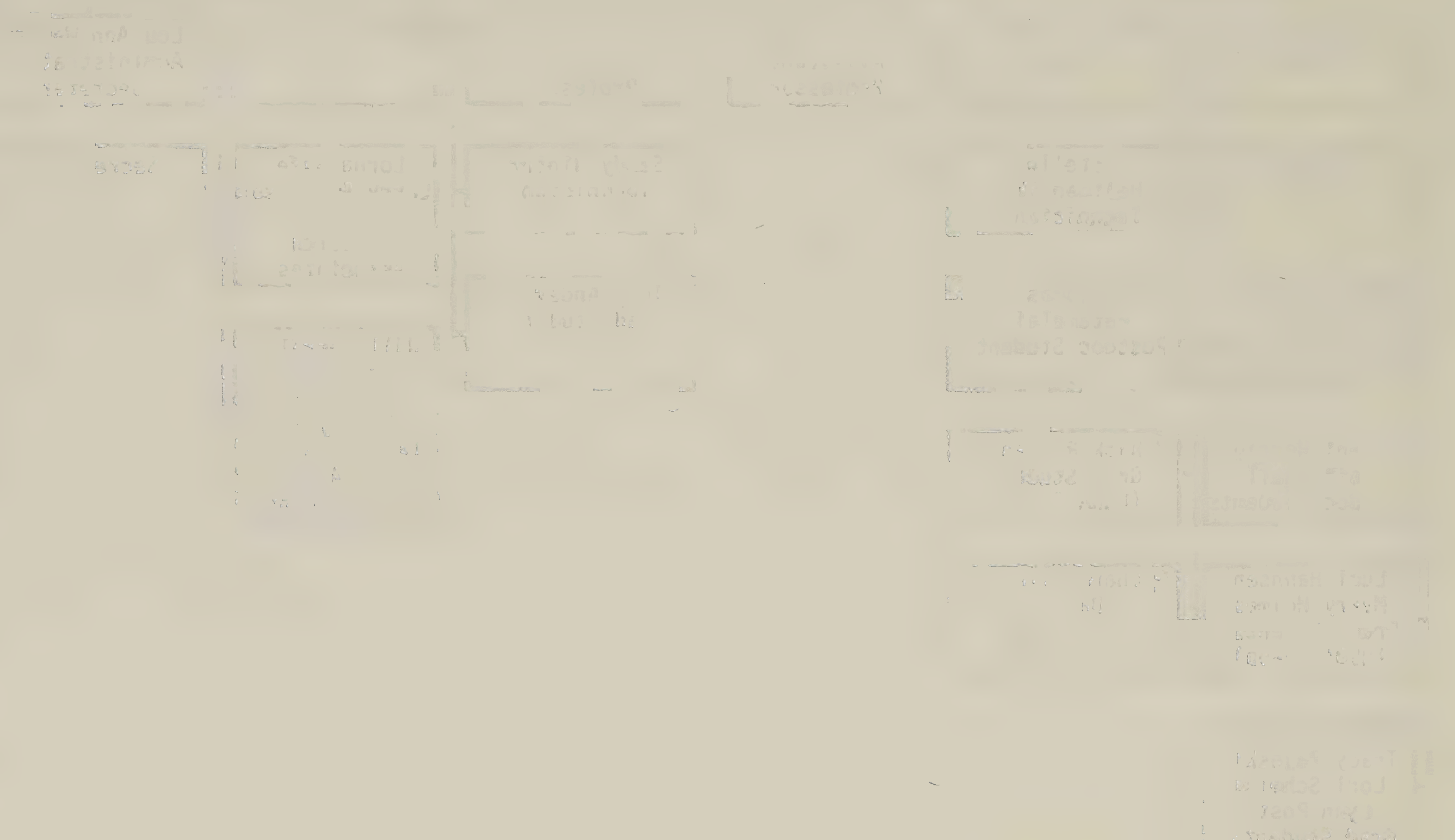
    - Rick Ridlen, Grad Student (USDA Co-op)
    - Charmillie Davis, Debbie Ridder, Grad Students
  - Dan H. Jones, Assistant Professor
  - H. L. (Andy) Kim, Assistant Professor
    - Sandy Winter, Technician
    - Tony Anderson, Grad Student
  - Steve H. Safe, Professor
    - Lorna Safe, Larry Robertson, S. Bandiera, Research Associates
    - Jill Merrill, Ian Lambert, Tom Fortier, Vic Sylia, Lee Ann Gage, Janet Andres, Grad Students
  - Lou Ann Waskom, Administrative Secretary
    - Secretarial Staff



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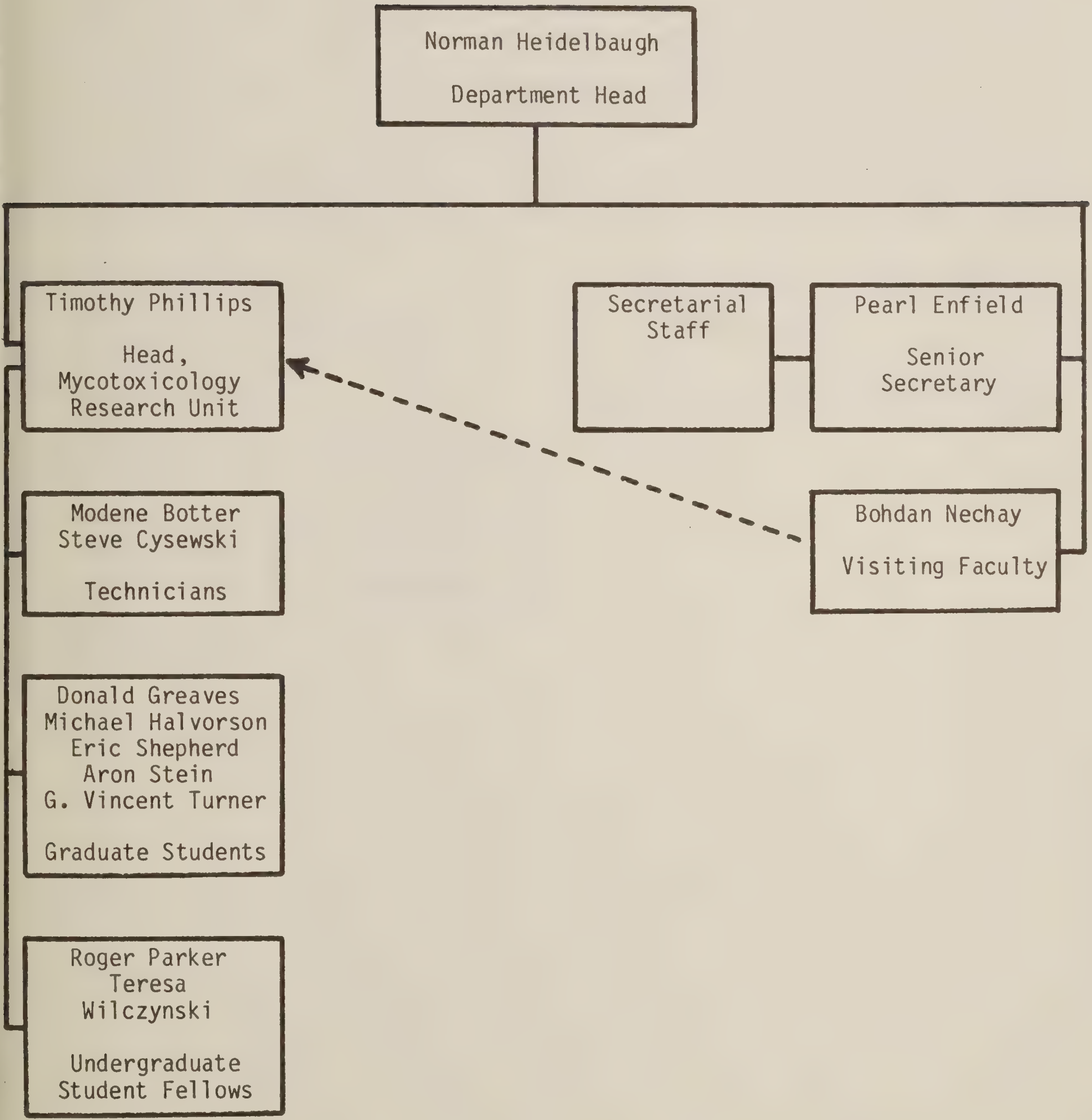
Lorna
Sally
Postdoc Student
Lori Hanson
Harry Holmes
Tracy
Lori Schmit
Post

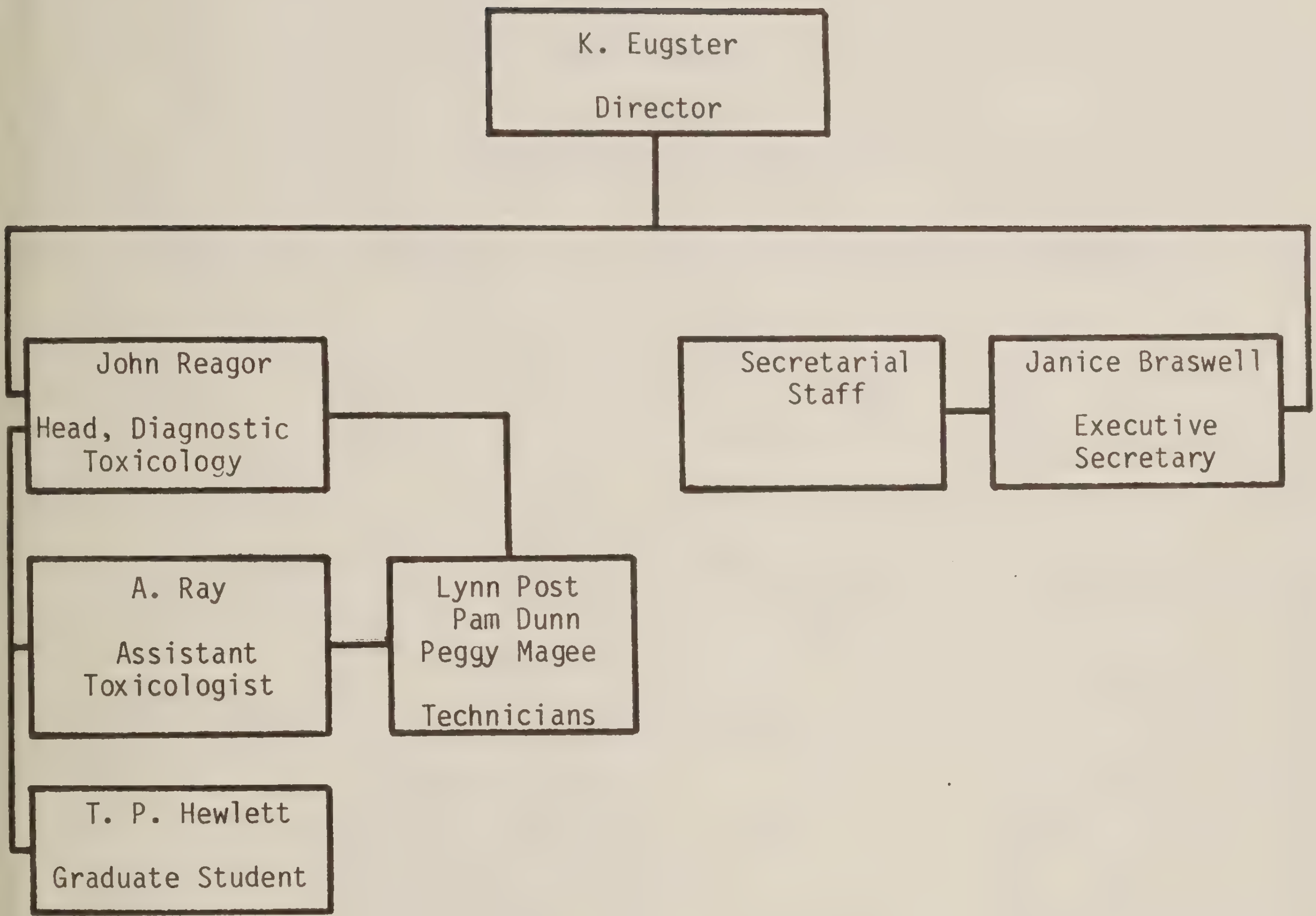
DEPARTMENT OF VETERINARY PUBLIC HEALTH - TEXAS A&M UNIVERSITY

TOXICOLOGY SECTION



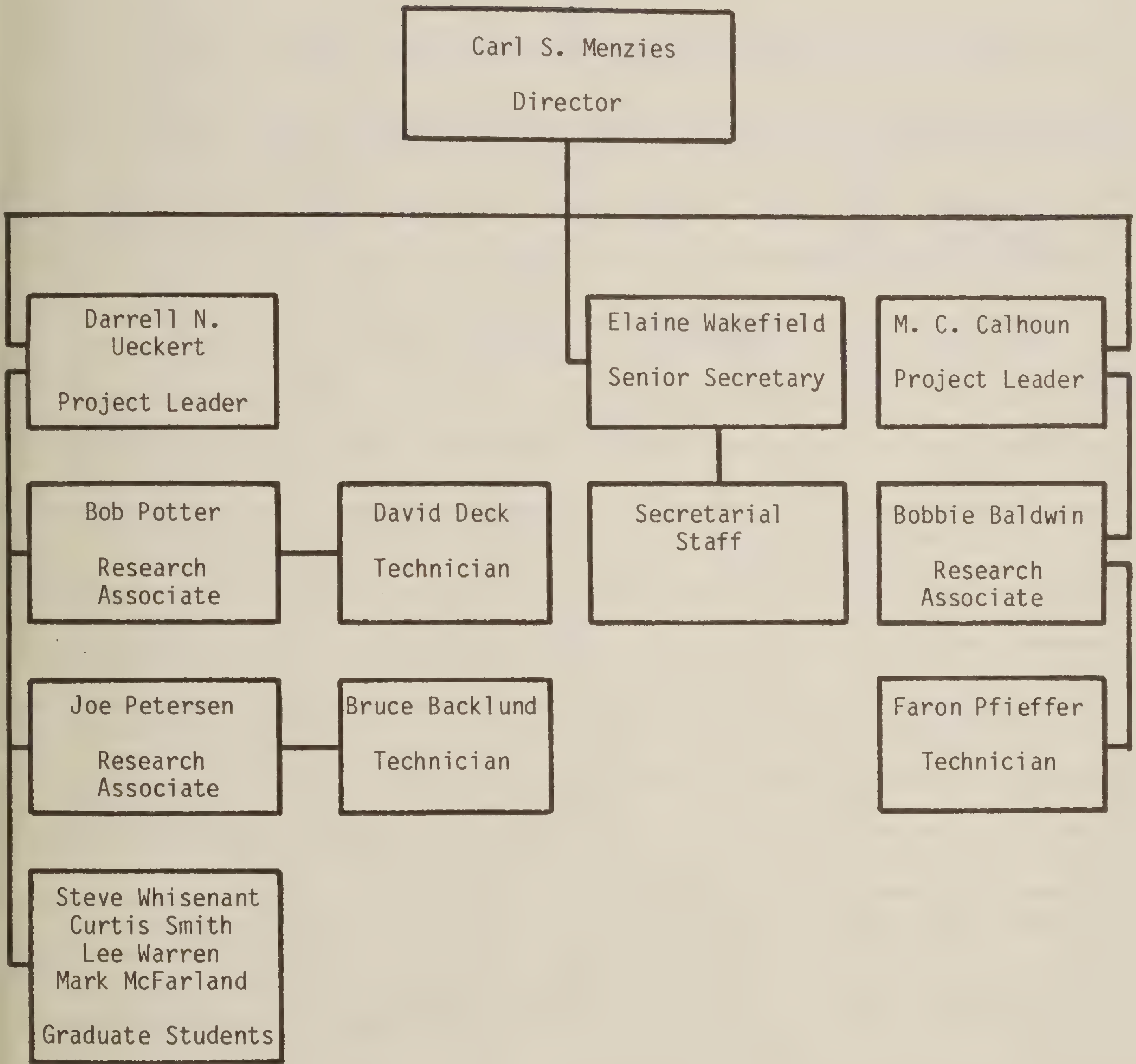
TEXAS VETERINARY MEDICAL DIAGNOSTIC LABORATORY

TOXICOLOGY SECTION

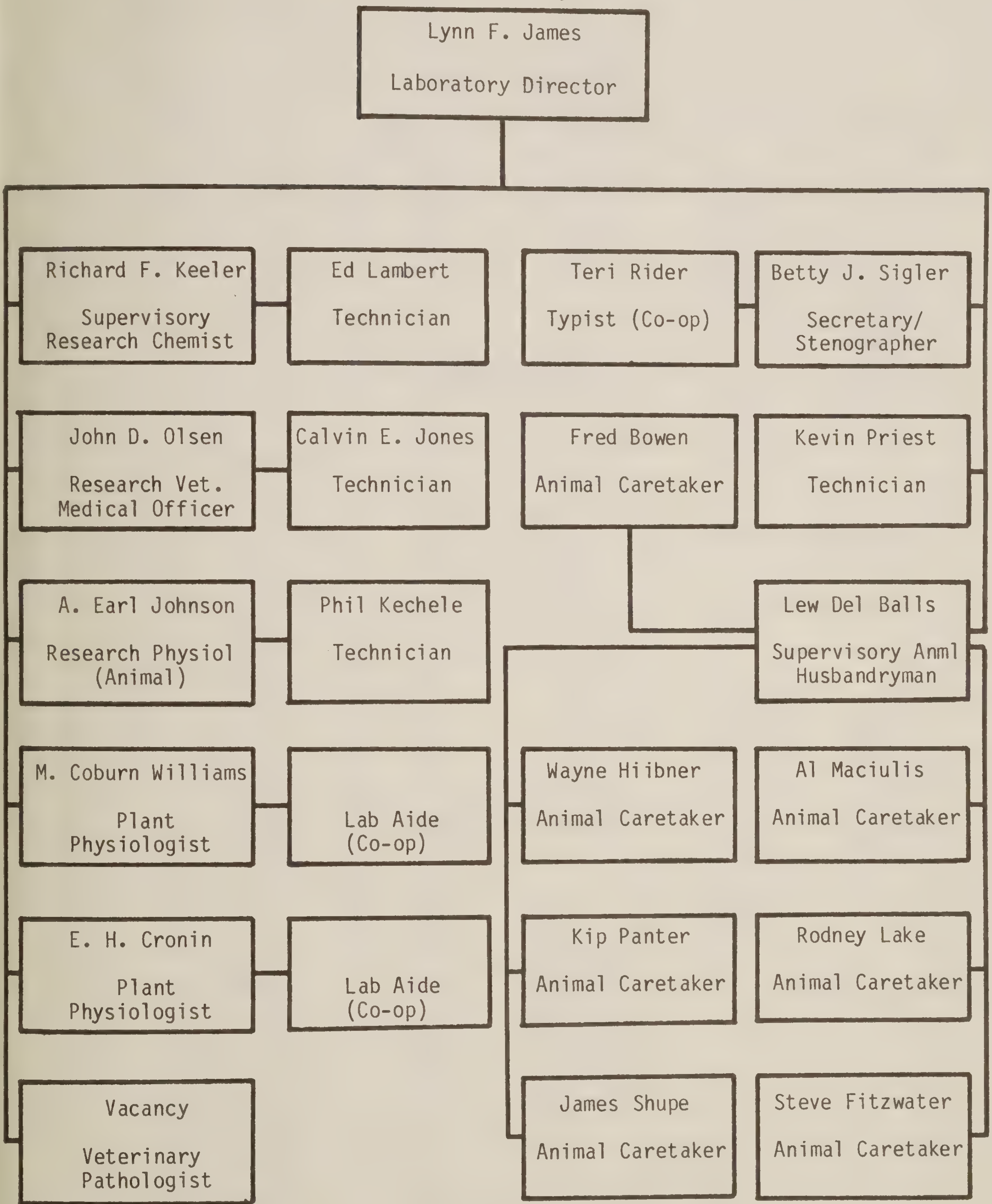


TEXAS AGRICULTURAL EXPERIMENT STATION - SAN ANGELO

TOXICOLOGY SECTION

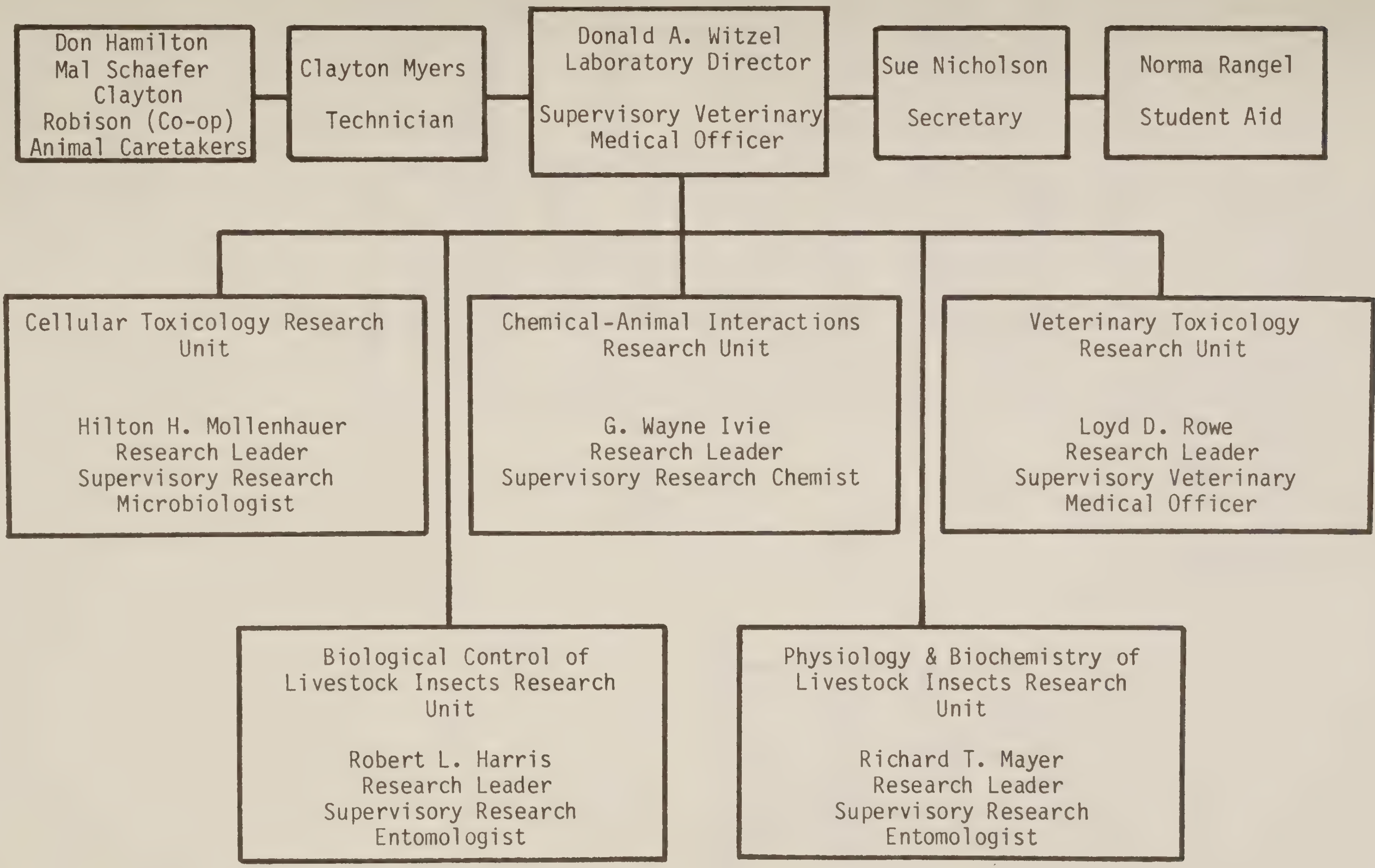


POISONOUS PLANT RESEARCH LABORATORY - LOGAN

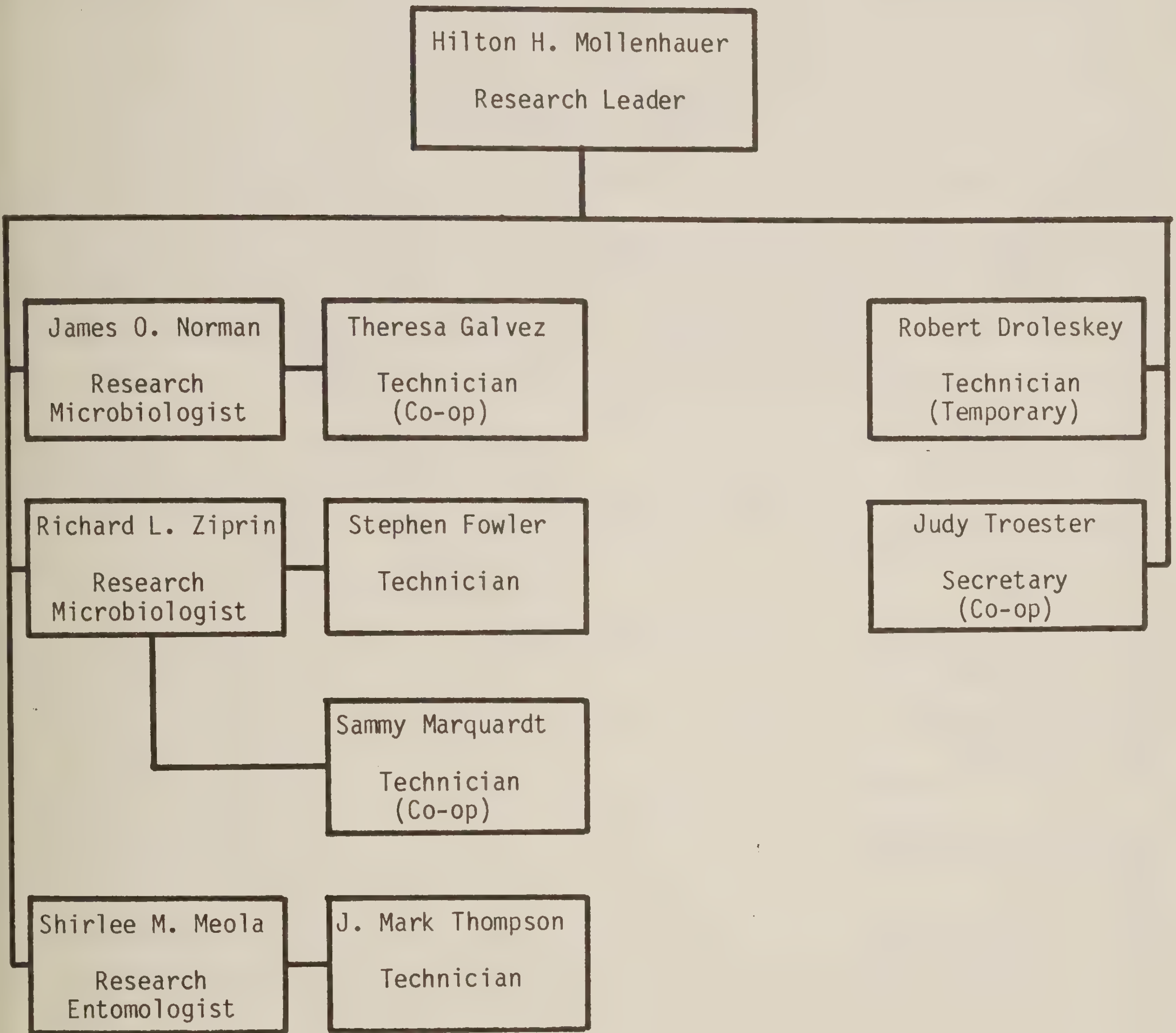


VETERINARY TOXICOLOGY AND ENTOMOLOGY RESEARCH LABORATORY

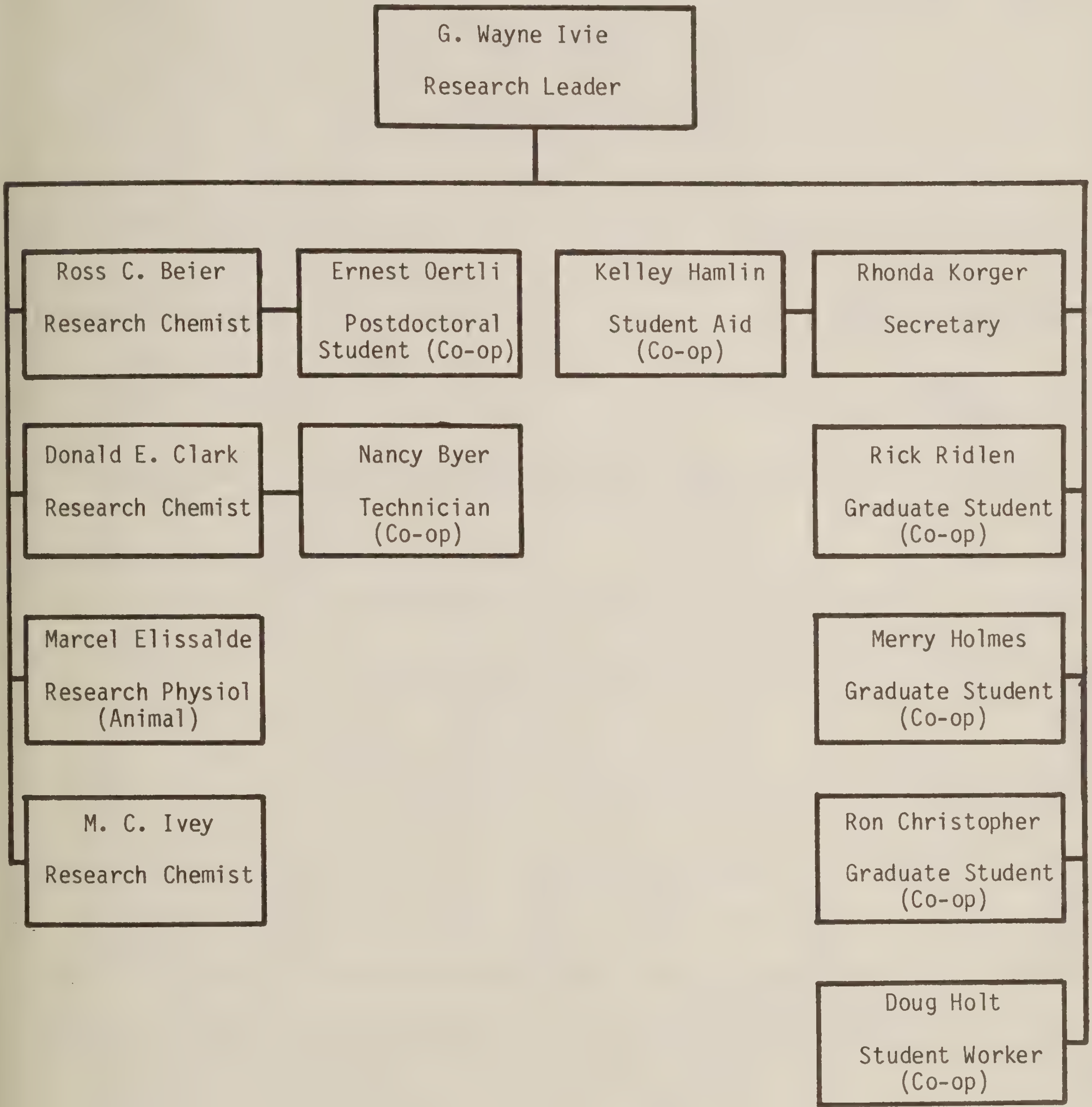
AGRICULTURAL RESEARCH SERVICE, USDA, COLLEGE STATION, TEXAS



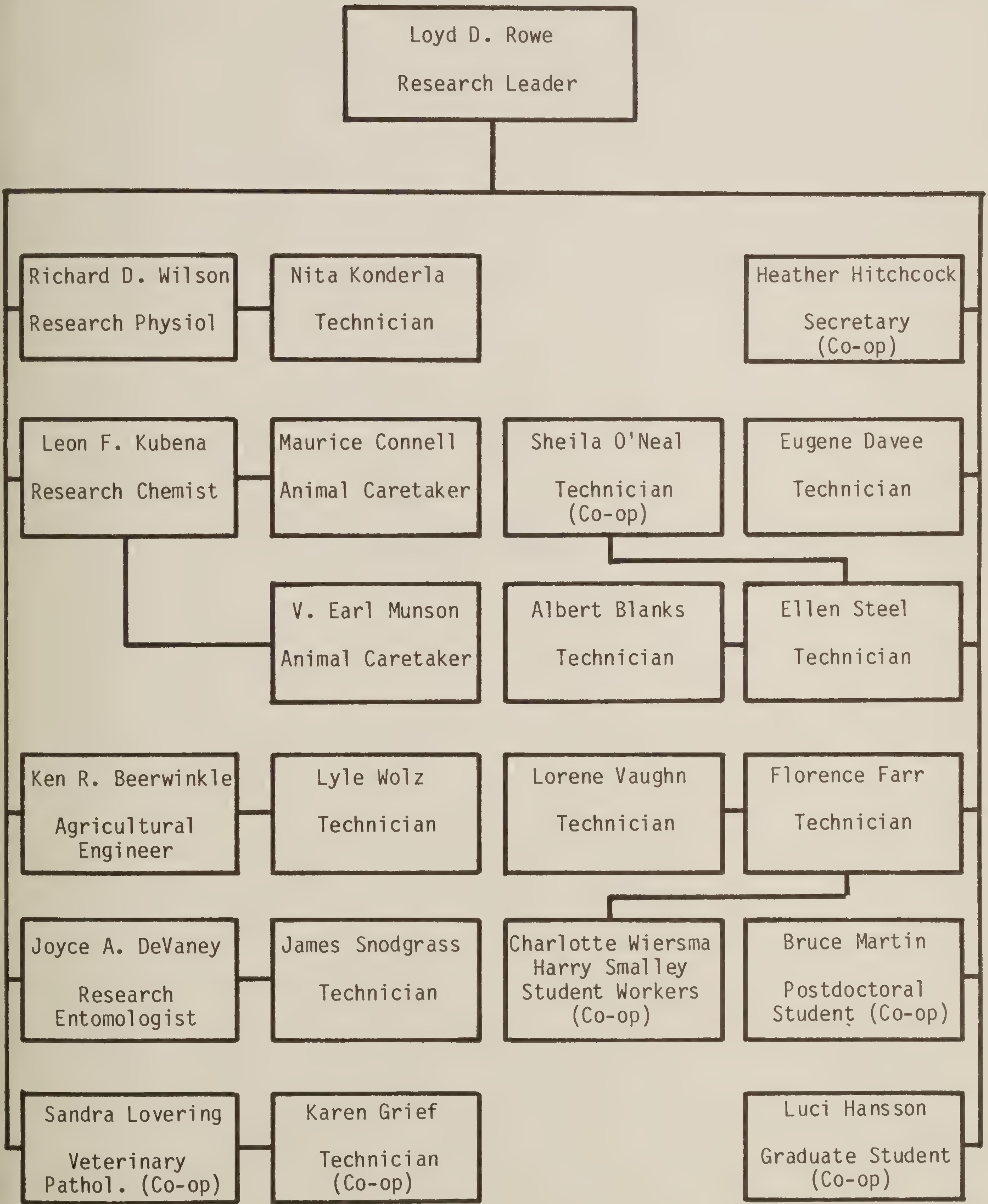
CELLULAR TOXICOLOGY RESEARCH UNIT - VTERL



CHEMICAL-ANIMAL INTERACTIONS RESEARCH UNIT - VTERL



VETERINARY TOXICOLOGY RESEARCH UNIT - VTERL



OVERVIEW OF PROGRAMS

VETERINARY TOXICOLOGY

General Objectives

The mission of the Veterinary Toxicology Research Unit, VTERL, and of the veterinary toxicology research efforts, TAES/TAMU, is to reduce losses in the production of livestock and poultry due to the harmful effects of toxic agents. Classes of toxic agents dealt with include agricultural chemicals, veterinary products, feed or environmental contaminants, and naturally occurring materials.

Specific Research Goals

1. Identification of toxic materials that have potential for reducing productivity in animal agriculture and determination of the effects of these toxicants upon livestock and poultry by means of toxicological studies on the target species. Research will seek to determine the behavioral, physiological, biochemical and pathological changes occurring in animals as a result of specific intoxications.
2. Identification of the toxic principle(s) if the agent under consideration is not a purified material.
3. Study of the biomechanism of action leading to poisoning or reduced productivity.
4. Investigation of antagonists and techniques that may be useful in prophylaxis against and/or therapy for toxicoses in livestock and poultry.
5. Investigation of interaction of toxicants with environmental factors and with other toxicants.
6. Development or evaluation of improved methods for the evaluation of important physiological functions in poisoned animals.

7. Develop methods for the control of the Northern Fowl Mite in commercial poultry operations.

Recent Research Accomplishments

VTERL

1. The toxicity of TRICLOPYR (3,5,6-trichloro-2-pyridinyloxy acetic acid), a new herbicide with a potential for use on rangeland, has been investigated. Seven-day acute toxicity trials were done in cattle at daily oral dosages of 75, 150, and 300 mg/kg body weight with the following materials: (a) technical triclopyr ethylene glycol butyl ether ester; (b) formulated triclopyr ethylene glycol butyl ether ester; and (c) formulated triclopyr triethylamine salt.
2. Acute toxicity studies in goats involving the following herbicidal materials have been completed: (a) glyphosate; (b) isopropylamine salt of glyphosate; (c) a formulation of the isopropylamine salt of glyphosate=Roundup[R] herbicide; and (d) a novel formulation of the isopropylamine salt of glyphosate. In all of these studies data were collected for documentation of the dose-response relationship to assess hazard. The observations on clinical signs of illness, feed consumption, body weight changes, clinical biochemistry, hematology, and histopathology were made to characterize pathologic effects and provide diagnostic criteria.
3. Vanadium, a common component of commercial phosphorus source materials used in poultry diets, was studied to determine the influence of various levels on selected parameters in poultry. Vanadium levels of 25 to 100 ppm in the diet delayed the onset of egg production. After eight 28-day laying periods, only birds receiving 100 ppm had body weights lower than controls. Hen-day egg production was reduced 13, 20 and 56% at levels of 25, 50, and 100 ppm respectively. Hatcha-

bility was affected more than production with a reduction of 28, 50, and 67% at 25, 50, and 100 respectively. No adverse effects due to treatment were observed in progeny.

4. Nervous system damage in delayed neurotoxicity induced by the organophosphate anthelmintic haloxon was studied using electrophysiological methods. The contractile strength of skeletal muscles, nerve conduction velocity, and somatosensory-evoked responses were recorded from affected and control animals. The results of the study indicate that the primary neural damage accounting for the posterior incoordination was in the sensory tracts of the spinal cord.
5. The effects of droplet size of respirable aerosols on deposition in the respiratory tract has been studied. Relationships for percentage aerosol loss as a function of droplet size were established for weanling calves and adult sheep freely breathing polydispersed aerosols with droplet diameters ranging from less than 0.5 to 10 μm. The quantities of aerosol deposited in the lungs of calves and sheep were 7 and 4% respectively, of the total aerosols breathed.
6. Studies with the northern fowl mite (Ornithonyssus sylviarum) have shown that 80 to 200 microliters of blood are ingested daily per 100 mg mites. From these results it is estimated that a heavy mite infestation (50,000 mites) can ingest 6% of a hen's blood daily.
7. An electronic instrumentation system was developed to evaluate the effects of atmospheric composition on migratory activity of northern fowl mites. Experiments utilizing this system demonstrated significantly higher levels of physical activity for mites exposed to human breath or CO_2-dry air mixture compared to mites exposed to dry air, 40 ppm NH_3 in dry air, or 100 ppm CH_4 in dry air. These results indicate that CO_2 emission by potential hosts may be a factor contribut-

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ing to the host-seeking ability of these mites and, thus, the dispersal of the mites throughout a flock.

TAES/TAMU

8. The toxicity of antimony to channel catfish (*Ictalurus punctatus*) was investigated. Antimony was found to be a moderate hazard to the catfish and shown to be able to bioaccumulate in the human food chain.
9. Veterinary Physiology and Pharmacology currently has a quality control contract with the Penwalt Corporation for testing various batches of methyl parathion and diazinon. This contract supports the training of several graduate students.
10. Dr. E. Murl Bailey participates in field investigations of animal losses to ascertain the extent of the problem and determine etiologies. These field investigations many times lead to new research endeavors.

Strengths and Weaknesses - VTERL

Facilities and equipment possessed by or available to the Veterinary Toxicology Research Unit are excellent and fulfill most needs. The northern fowl mite project is in need of a completely separate building where chemical studies may be conducted under GLP guidelines. The good working relationships that exist with the Chemical-Animal Interactions Research Unit for Chemistry support and the Cellular Toxicology Research Unit for electron microscopy, immunology, and microbiology support are highly desirable for mustering multidisciplinary teams for in-depth approaches to toxicological problems.

Close proximity to TAMU's excellent library facilities is an obvious asset. It is particularly advantageous that we are located close to an excel-

lently staffed and highly utilized state veterinary diagnostic laboratory. This laboratory functions as a central reporting point for veterinary toxicological problems for a large part of the region we serve. Close communication between research toxicologists and diagnostic toxicologists can lead to rapid identification of important problems needing research. Lack of sufficient professional staff is the most serious weakness of VTERL. At least one additional veterinary toxicologist is needed. Over the last 3 years the unit has had a net loss of 2 scientists which has significantly reduced our capacity to take on new work, especially general toxicology projects in livestock. It is true that the unit has been able to compensate somewhat through the use of graduate students, however additional scientific staff is needed to generate and oversee projects and provide our graduate students with adequate direction and aid. The employment of a nuerotoxicologist would allow accelerated development of our embryonic and at present slowly growing neurotoxicology program.

TAES

The strengths of the TAES veterinary toxicology program are listed in the plant toxicology section. The greatest weakness in the veterinary toxicology program is a lack of travel expenses to undertake field investigation.

Future Direction - VTERL

The Veterinary Toxicology Research Unit will continue to pursue its mission and specific research goals as stated above. Increased activity is anticipated with regard to development or evaluation of novel organ function tests. Organ function tests of increased sensitivity and/or selectivity would enable us to more accurately evaluate the effects of toxicants in livestock and poultry.

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TOXIC PLANTS

LOGAN

General Objectives

The mission of the USDA Poisonous Plant Research Lab is to investigate poisonous plants, their toxins, their mode of action and to develop methods to prevent livestock losses due to these plants.

Poisonous plants are one of the most important causes of economic loss to the livestock industry. These losses are due to livestock deaths, abortions, decreased performance, weight losses, chronic illness, debilitation, photosensitization, birth defects and others. In addition to these direct losses, land managers and livestock men have increased costs and problems associated with grazing range and pastures infested with poisonous plants. These costs and problems include increased fencing, decreased forage utilization, altered grazing programs, supplemental feeding programs, and increased veterinary fees.

The USDA Poisonous Plant Research Laboratory focuses their research program on investigating ways to prevent these losses.

Specific Objectives

1. Identification of the toxic and teratogenic principles of poisonous plants.
2. Study of the mechanisms by which plant toxins exert their effects on livestock.
3. Development of diagnostic procedures for the detection of livestock poisoning by plants.
4. Identification of the conditions under which livestock poisoning by plants occur.

5. Development of methods for the prevention of livestock poisoning by plants.
6. Development of economical methods for the control of poisonous plants.
7. Study of the physiology and biochemistry of range weeds.
8. Interception of introduced poisonous plants before their release for public and private use.

Recent Research Accomplishments

In studying plants that might be considered for introduction into the U.S., collection was made of over 1,600 samples of foreign *Astragalus* from European herbaria and information was published on 225 species that contained toxic aliphatic nitro compounds. Research was also completed on the type of nitro compound found in these and North American species of *Astragalus*. It was determined that *Galenia pubescens*, an introduced species, synthesized toxic amounts of both soluble oxalates and nitrates and that one already released species of *Lotus* synthesized 3-nitroproprionic acid in amounts toxic to livestock. It was determined that other *Lotus* species synthesize 3-nitroproprionic acid. Several *Indigofera* species were also found to synthesize nitro compounds and to be toxic to one-week-old chicks. Purposefully introduced plant species that have become weeds cost the nation hundreds of millions of dollars annually.

Plant species growing throughout the United States that contain pyrrolizidine alkaloids and are important economically for their toxicity to livestock have been analyzed quantitatively and qualitatively throughout their growing cycle for their pyrrolizidine alkaloid content.

An economical and effective method of controlling the tall larkspurs on high mountain ranges was established. This method results in an internal rate of return on monies invested in their control of over 60%.

Larkspur is one of the principle poisonous plants of cattle in the West. It was proven that a mineral supplement can reduce the clinical signs and lethal effect of larkspur. Toxicity of larkspur can now be reliably measured by mouse bioassay providing means for estimating risk of cattle being poisoned on the range and providing an essential standard for laboratory studies. Marked differences in toxicity have been measured among species of larkspur and between growth sites of one species. Bur buttercup was shown to be a highly toxic plant for sheep.

It has been shown that a cyclopia type malformation in sheep "Malformed lamb disease" was caused by the maternal consumption of *Veratrum californicum* early in gestation. The teratogen in veratrum was subsequently identified. A management program was established for the prevention of this condition which has resulted in the saving of hundreds of thousands of dollars for the sheep producers of central Idaho.

It has been shown that lupine was the cause of a skeletal malformation in calves born to cows grazing lupine in certain areas of the West. The lupine teratogen was identified using information on the time of insult to the fetus and the level of the teratogenic compound in the plant during different stages of growth. A management program has been developed that has resulted in the savings of hundreds of thousands of dollars to cattle producers in the West.

Halogeton glomeratus is an introduced annual that grows on the colder, saline, arid and semi-arid ranges of the West. This plant has been the cause of deaths of thousands of sheep. A management system has been developed that has done much to minimize these serious losses.

Locoweed, various species of the genera *Astragalus* and *Oxytropis*, is one of the most serious poisonous plants growing on the ranges of western United

States. Much has been done to work out the etiology of poisoning and the physiopathologic effects of the locoweed toxin.

It has been shown that sheep must graze Artemisia nova just prior to or in conjunction with Tetradymia glabrata for photosensitization to develop. This condition known as "big head" has been a serious problem to those livestockmen grazing sheep on some desert ranges in the early spring. This finding has been of great financial benefit to these people in preventing this condition.

Strengths and Weaknesses

The USDA Poisonous Plant Research Laboratory is located near the geographic center of the range states so that personnel have good access to those areas.

The USDA Poisonous Plant Research Laboratory enjoys excellent cooperative and working relationships with the various Federal agencies, State Experimental Stations, State Extension and with livestock groups that are concerned with the problems of poisonous plants. Cooperative research has been conducted with many of them. Cooperation is done not only on a national but on an international basis.

The physical facilities for the housing and handling of large animals are excellent. An annual budget is required for repair and maintenance. Efforts are made to keep facilities in good condition, not only to keep equipment functional, but for the benefit of the many visitors that come to the USDA Poisonous Plant Research Laboratory.

Equipment is adequate for the support of good research at the USDA Poisonous Plant Research Laboratory. However, as the research staff moves into new areas of endeavor, new equipment is needed to support their research. Also, some expensive equipment should be replaced; for example, the mass spectrometer.

We have requested that a veterinary pathologist, a biochemist, a plant scientist and support help for them be added to the staff. We feel this would give better balance to the staff. We are in the process of obtaining a staff pathologist.

Future Directions

The USDA Poisonous Plant Research Laboratory will continue to pursue its mission to investigate poisonous plants, their toxins, the mode of action of toxins, and to develop methods to prevent livestock losses due to poisonous plants.

Field investigations are conducted and contact is maintained with Federal and State agencies who are responsible for the management of ranges, pastures, and forage production and with the livestock community. Information from these contacts and investigations are used to identify problems for research. As problems are solved, research will be undertaken on other poisonous plants, selected on the basis of field investigations and contact with Federal agencies and livestockmen.

The USDA-ARS-Poisonous Plant Research Laboratory has participated in program reviews with the Utah State University wherein the Toxicology programs were considered in 1972 and again in 1978.

The review panels in both 1972 and 1978 commended the USDA Poisonous Plant Research Laboratory for their excellent research programs. Two summary statements made in the 1978 program review follow:

1. "The ARS program related to plant poisoning is unique to the nation. The staff is very competent and productive. The State of Utah is fortunate to have this unit located in Logan."
2. "The USDA scientists are responsible for the remaining weed science project numbers 419, 420, and 765, in the Poisonous Plant Research

> Laboratory. It is obvious to the review panel that this laboratory has achieved national and international prominence. It has rendered valuable service to the entire U.S. and to Utah State University in the field of Rangeland Weed Science."

Our research program has been reviewed extensively by members of the Headquarters Staff (NPS and others), regional staff, area staff, and local and national experiment station staff.

TAES/VTERL - COLLEGE STATION

A 1960 report indicates that losses in food producing animals due to plant toxicoses is in excess of $15,000,000 yearly and may approach $100,000,000 in some years. Because of this enormous economic loss, either in animal deaths or reduced growth efficiency, it is imperative that there be continued emphasis on investigating means of not only reducing losses but also increasing food output in the affected areas.

General Objectives

There are about 100 poisonous plants in the pastures of Texas whose toxic principles and natures of toxicity are, in most cases, unknown. This does not include ornamental or introduced plants. In order to establish the effective means to prevent the toxicity and/or treat the intoxicated livestock, the toxic actions of the plants and the toxicants in them should be understood.

The approach in investigating plant related animal diseases is:

1. Ascertain extent of disease condition.
2. Identify plant if possible.
3. Field trips to consult with veterinarians and animal producers.
4. Collecting of plant material and feeding laboratory animals or species involved attempting to reproduce disease syndrome.
5. Isolation and identification of offending toxicant.
6. Determination of mode of action.
7. Development of antidotal or management procedures to prevent intoxication.

Specific Research Goals

The seed of *Sesbania* species which is lethal to cattle contains toxic and antileukemic compounds. The oral, lethal dose of the ground seed is about 0.5 g/kg body weight in rabbits. A toxic extract is prepared and further purification is carried out to isolate the toxic principle.

Lobelia berlandieri is a poisonous plant which causes sporadic but heavy losses of cattle during certain years. A toxic extract was prepared and two piperidine derivatives were detected in the extract by GC-MS. The isolation of these two alkaloids is being attempted.

Cardiotoxic properties of helenalin and tenulin, sesquiterpene lactones, were known for some time. The cardiotoxic effects of some sesquiterpene lactone derivatives will be examined. Newly synthesized sesquiterpene lactone derivatives will be submitted to other laboratories for the antileukemic screenings.

Two antioxidants butylated hydroxyanisole (BHA) and ethoxyquine (EQ) are known to increase the hepatic sulfhydryls in rats and mice. Toxicants such as sesquiterpene lactones are alkylating agents binding rapidly with biological nucleophiles, sulfhydryls *in vivo*. Other toxicants such as pyrrolizidine alkaloids are known to be activated to toxic alkylating agents *in vivo*.

The toxicity of hymenoxon, a toxic sesquiterpene lactone isolated from bitterweed, and of a mixture of pyrrolizidine alkaloids isolated from *Senecio longilobus* were reduced in BHA or EQ pretreatmented mice.

This concept will be expanded in applying other toxicants such as aflatoxins and other mycotoxins.

A more effective glutathione inducer 2-tert-butyl-4-hydroxy-anisole will be synthesized and its antidotal effects in several animal species will be examined.

Indigenous plants are very plentiful in Texas and it appears that over 1/3 of the grazing area in the state may not be utilized to its greatest extent with sheep. The most actively investigated plant in the area is Hymenoxys odorata (bitterweed). An active principle has been isolated from the weed and the disease condition has been reproduced. However, the mechanism of action of the suspected toxicant has not been elucidated. An amino acid, cysteine, has been shown to be protective against the plant toxicant but a feasible method for introducing a sufficient quantity of the chemical into animals has not been developed. Continued efforts will be made to develop managerial and/or prophylactic techniques against bitterweed poisoning in sheep, as well as attempts to determine the mechanism of action. Cattle may also be affected by this plant, however the incidence of the disease condition is very low.

Helenium spp. (sneeze weeds) are a troublesome species throughout the state. A toxic principle has been isolated but extensive animal studies have not been undertaken except in laboratory animals. The mechanism of action of the toxicant is unknown. Therapeutic and prophylactic measures have yet to be developed.

Baileya multiradiata and Psilostrophe spp. are plants that are very toxic to sheep. Very few investigations except for field feeding trials have been undertaken. These two plants, which occur in the Trans-Pecos region, prohibit the use of these areas for sheep production. A complete investigation of these plants will be undertaken in an attempt to develop means of negating their toxic action and return a large area of Texas to sheep production.

There are other Composite species in the state including Conyza spp. in which their effects on livestock production are unknown. Continued efforts will be directed towards investigating these plants.

In addition to the composites, there are considerable numbers of indigenous plant species which are a problem to livestock. Among these of current

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interest are the Solanums (nightshades) and Astragalus spp. (locoweeds and pea-vines). These species are suspected in the "Crazy Cow" syndrome, an ill defined CNS condition in parts of Texas. The disease condition is one in which there is a loss of the Purkinje cells in the cerebellum. Currently, attempts are being made to feed suspect material to rabbits. Positive lesions and signs in rabbits will enable the development of a more detailed protocol in laboratory or other animal species.

Hard Yellow Liver is a disease condition of suspected plant etiology in most ruminants. Over 80 plant species have been fed to animals in the past 30 years but the lesion has not been reproduced. Current plans are to start grazing trials on fenced plots in affected pastures. The Texas Sheep and Goat Raisers Association have supported this investigation in the past and there are still some funds available. The grazing trials are expected to take from 5 to 10 years to complete. During the trials, surveys will be made 3 to 4 times a year to adequately catalog the plant flora in the fenced plots.

Introduced plants cause problems in animals as well as indigenous plants. There is current interest in kleingrass and fescue grass.

Photosensitization in 60 to 90 pound lambs has been associated with the grazing of kleingrass. Grazing trials are being developed in association with the San Angelo Experiment Station in an attempt to better define the disease condition. We hope to establish the toxic principle(s) of kleingrass and determine the effects of sporidesmin on mixed-function oxidase system of the rabbit.

Fescue grass is being developed for forage in much of North Texas. The disease condition associated with this grass is one of an ergot-like syndrome with both the gangarene and nervous signs present. Investigators in this department are cooperating with staff from the Dallas Station to better define this disease condition. Current goals with Fescue include:

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th staff, and the Utilization Section to better define

to include:

1. Identify the toxic agent(s) associated with Fescue grass.
2. Develop HPLC methods for the alkaloids of Fescue grass.
3. Study the cardio-vascular effects of halostychine present in Fescue grass on the bovine.

Recent Research Accomplishments

TAMU/TAES

Hymenoxon, a toxic sesquiterpene lactone, was isolated from *Hymenoxys odorata* DC. (bitterweed) and its structure was determined including the relative stereochemistry by x-ray diffraction method. Toxicity of hymenoxon and its derivatives were determined. Hymenoxon toxicity in sheep and dogs was prevented by L-cysteine when injected simultaneously or immediately following hymenoxon. Hymenoxon toxicity in mice was also prevented by feeding butylated hydroxyanisole (BHA) or ethoxyquin (EQ) in the diet. BHA pretreatment also prevented the acute toxicity of bitterweed in sheep.

Four metabolites of hymenoxon were isolated from bitterweed-fed sheep urine and one of them was characterized by high resolution nmr spectra.

Basal activities of hepatic microsomal aniline hydroxylase were compared in sheep previously determined to be either bitterweed-susceptible or bitterweed-resistant, and no significant difference was found between the susceptible and the resistant sheep. This study suggests that the cytochrome P_{450}-dependent mixed-function oxidase system does not have a central role in the metabolic detoxification of hymenoxon.

A toxic extract was prepared from *Lobelia berlandieri*, an annual plant which causes occassional heavily losses of cattle. The toxic extract caused myocardial damage in mice and dogs and lowered the blood pressure in the dogs. Two alkaloids in this extract were tentatively identified as piperidine derivatives based on the mass spectral data.

A toxic and antileukemic extract was prepared from Sesbania vesicaria seed. The oral, lethal dose in rabbits was about 30 mg/kg and the T/C value of 150 was found with 2 mg/kg doses in vivo screening in mice.

Developed GC methods for the analysis of halostychine in Fescue grass. Isolated a mycotoxin from Phomopsis spp.

VTERL

Cassia roemeriana, a plant common to Central and West Texas, Oklahoma, New Mexico, and Mexico (Neuvo Leon and Coahulia), has been shown to produce toxic myopathy in cattle. This finding confirms the etiology of many cases of naturally occurring myodegenerative disease in ruminants in West Texas and New Mexico.

Oligomeris linifolia (Desert spikes), a plant found from the Rio Grande Valley and Trans-Pecos of Texas to California and northern Mexico has been found to be poisonous to cattle. Poisoned animals exhibit signs of central nervous systems stimulation, and sometimes pulmonary emphysema or hemoglobinuria. As a result of this finding, O. linifolia becomes the prime suspect as the causative agent for recent outbreaks of illness in cattle exposed to the plant.

Thamnosma texana (Dutchman's breeches), has been shown to be a potent photosensitizing range plant of the Western Edwards Plateau region of Texas for grazing ruminants. Chemical investigations have shown that photoactive psoralens are most likely responsible for the phototoxic effects observed.

Strengths and Weaknesses - TAES/TAMU

1. Excellent teaching program in toxicology.
2. Numerous agricultural problems in Texas relative to toxicology.
3. Sufficient graduate students interested in the area of toxicology.

4. Excellent technical support.
5. Need additional equipment to replace some equipment that has become obsolete.
6. Lack of in-house mass spectroscopy to conduct toxicologic research at the molecular level.
7. Lack of laboratory space specifically designed for chemical studies.
8. More interactions and cooperative programs are needed among the existing staff of separate units.

Future Directions - TAES/TAMU

Isolations and characterizations of the toxicants will be continued and will be expanded with the increased enrollment of graduate students and the availability of better instrumentation. Metabolic studies, *in vitro* and *in vivo*, of the known toxicants and their analogs will also be expanded. Applications of the fundamental research results should be considered for the benefit of the public. Attempts will be made to place greater emphasis on the role of mycotoxia in animal health and agricultural products.

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TAES - SAN ANGELO

General Objectives

Develop range improvement techniques and systems for reducing livestock losses from poisonous plants in the Edwards Plateau and Trans-Pecos resource areas of Texas.

Specific Objectives

1. Evaluate chemical, mechanical, biological and prescribed burning methods for efficient and economical control of woolly locoweed, garbancillo, threadleaf groundsel, bitterweed, tarbush and prickly-pear.
2. Evaluate selected shrubs, legumes and cool-season grasses for improvement of quality of rangeland forage and for reducing consumption of toxic plants by livestock.
3. Develop less expensive techniques for herbicidal control of toxic plants on rangeland.
4. Development of an effective supplement (treatment) for sheep grazing bitterweed infested ranges.
5. Define bitterweed tolerance in sheep.

Recent Research Accomplishments

1. Bitterweed - Have finished field research and published paper on herbicidal control of bitterweed. This work documented that herbicide 2,4-D, the "standard recommendation" for bitterweed control, is not consistently effective at temperatures below 72°F nor after bitterweed plants flower. Documented that bitterweed can be effectively controlled at 60°F temperature or below as well as after flowering with 2,4-D + dicamba (3:1), 2,4,5-T + picloram (1:1), or picloram.

Found that picloram and tebuthiuron at 0.56 to 1.12 kg/ha effectively controlled bitterweed for a year or more.

Have worked with Drs. Millard Calhoun, Bennie Camp and Leo Merrill in field research on the effects of herbicide 2,4-D on hymenoxon concentration of bitterweed and its toxicity to sheep. Basically we learned that 2,4-D decreases hymenoxon concentration of bitterweed and significantly reduces its toxicity to sheep. We also learned that range sheep can consume large quantities of bitterweed (50 to 100 pounds) without dying.

Have documented that all herbicides available for bitterweed control seriously reduce production of associated desirable forbs that are highly nutritious and important in winter diets of sheep, goats and cattle.

Have completed studies on rehabilitation of pipeline right-of-ways and concommitant pre-emergence herbicidal control of bitterweed. Learned that neither goal was practical in West Texas.

Are currently engaged in field research on rehabilitation of oil well drilling pads and slush pits (bitterweed hazard areas). Kochia and fourwing saltbush appear more promising than warm season grasses for rehabilitation of these critical areas.

Have published Extension Fact Sheet on "Managing Bitterweed to Reduce Sheep Losses". Have begun preliminary work to evaluate a mist blower for less costly herbicidal control of bitterweed. Have paper in press on germination requirements of bitterweed.

Established the relationships between voluntary feed intake and bitterweed dose and between levels of several serum constituents and bitterweed dose in subacute studies in sheep. Feed intake decreased linearly as bitterweed dose increased. Serum total protein and albu-

min decreased and urea nitrogen, creatinine and total bilirubin increased with increasing bitterweed dose over the range from 0 to 0.265% of live body weight/day (air-dry basis). Serum lactic dehydrogenase, aspartate transaminase and creatine kinase activities were only increased at the highest bitterweed dose (0.265%). Depression in voluntary feed intake was more sensitive to bitterweed dose than were the serum constituents.

A short-term assay for assessing treatments for reducing bitterweed toxicosis was developed based on the reduction in voluntary feed intake and changes in selected serum constituents (urea nitrogen, creatinine, asparate transaminase and γ-glutamyl transpeptidase) observed when sheep were repeatedly exposed to subacute levels of bitterweed. The assay consisted of administering bitterweed by stomach tube in aqueous suspension for four consecutive days at the rate of 0.25% of live weight per day (air-dried basis). Blood samples for serum were collected by jugular venipuncture initially and on days 3 and 5. Serum constituents were measured to assess response to bitterweed. This assay was used to assess the antidotal value of abomasal ℓ-cysteine infusions and the degree of protection provided by increasing the level of dietary crude protein. Infusions of ℓ-cysteine provided some protection against bitterweed toxicosis, but the level of ℓ-cysteine required to provide protection was also toxic to sheep. This problem, along with the fact that ℓ-cysteine is an unstable molecule and relatively expensive, makes use of this compound as an antedote for field cases of bitterweed poisoning unlikely. Increasing the crude protein content of the diet from 10 to 20% increased blood and rumen thiol levels and provided a slight degree of protection in cases of experimentally induced subacute bitterweed toxicosis. Vari-

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ation in tolerance to bitterweed poisoning among individual sheep was demonstrated by challenging lambs with a uniform subacute dose and measuring the response. A small percentage of bitterweed naive sheep were found to be very tolerant and on the other extreme a small percentage were found to be very susceptible. When these sheep were repeatedly challenged with a subacute bitterweed dose and allowed time to recover between challenges all the sheep eventually became very tolerant, indicating adaptation on repeated exposure.

2. Woolly locoweed - Have finished screening various herbicides for effective control of woolly locoweed. Applications of 2,4-D in fall, winter or spring did not satisfactorily control woolly locoweed in the Trans-Pecos area. Picloram at 0.2 to 1.1 kg/ha, alone or in mixtures with other herbicides applied in fall or winter, usually controlled woolly locoweeds for a year or longer. Woolly locoweeds were more susceptible to most herbicides during fall, compared to winter or spring, apparently because temperatures are more favorable for herbicide absorption and translocation and because the weeds are in more susceptible phenological stages. Have initiated research on germination requirements of woolly locoweed.

3. Threadleaf groundsel - Have finished screening various herbicides for effective control of threadleaf groundsel. 2,4-D did not satisfactorily control threadleaf groundsel in fall, winter, spring or summer. Foliar sprays of 2,4-D + picloram (4:1), 2,4,5-T + picloram (1:1) or picloram controlled threadleaf groundsel more effectively than other herbicides tested. Fall and winter application of herbicide sprays controlled threadleaf groundsel more effectively than spring or summer applications.

4. Rayless goldenrod - Have finished field research on control of rayless goldenrod with pelleted herbicides. Found that summer or fall application of picloram pellets at 0.5 to 1.1 kg/ha (a.i.) effectively controlled rayless goldenrod and substantially increased production of desirable forage plants. Winter burning did not control rayless goldenrod infestations.
5. Garbancillo - Finished one experiment on screening herbicides for effective control of garbancillo. 2,4-D applied in winter did not satisfactorily control garbancillo populations, whereas 2,4,5-T + picloram (1:1) completely controlled garbancillo infestations. Foliar sprays of picloram and 2,4-D + picloram (4:1) reduced garbancillo densities 84 to 91%.
6. Tarbush - Have finished field research on control of tarbush with pelleted herbicides. Picloram pellets and dicamba granules did not effectively control tarbush. Tebuthiuron pellets applied in late winter at 0.5 to 1.1 kg/ha effectively controlled tarbush and substantially increased production of desirable forage.
7. Pricklypear - Have demonstrated in extensive field research that prescribed burning in late winter in medium to heavy fine fuel loads (at least 2,000 kg/ha) reduces canopy cover of pricklypear 65 to 95%. Have initiated studies at two locations to develop a prescribed fire/herbicide system for management of pricklypear infestations on range sites or situations where fine fuel loads are inadequate for satisfactory suppression of pricklypear with fire as a single treatment. Are currently determining the germination characteristics of three species of pricklypear.
8. Shrubs for improving forage quality - Have developed expertise in propagating fourwing saltbush for use in field research. Have in-

stalled preliminary experiments to determine adaptation of fourwing saltbush and littleleaf leadtree on three different soil types in the Davis Mountain region. Have collected seeds from four native populations of fourwing saltbush in West Texas and established nurseries at San Angelo, Barnhart and Marfa to study ecotypic variation and select most productive and best adapted assessions for future field work.

9. Hard Yellow Liver - Cooperated with Drs. Murl Bailey and Gary Adams for three years in field aspects of HYL research. Conducted vegetation and soil surveys in experimental pasture and determined diets of experimental animals for three years by microhistological technique. Recognized abundance of fungi on range plants during hard yellow liver year and cooperated with Dr. Charles Bridges by collecting and shipping plants infested with fungi for identification, culturing, and feeding experiments.

10. Kleingrass - Cooperated with Dr. Murl Bailey and Ruth Taber in field studies in which fungicides were evaluated in relation to the fungus *Pithomyces chartarum* and swellhead in sheep on kleingrass pastures.

Strengths and Weaknesses

Strengths of the current program include:

1. Being headquartered in fairly close proximity to several serious poisonous plant problems.
2. Fairly adequate funding and excellent support from the Texas Agricultural Experiment Station for this type of research.
3. Producer awareness and support for this type of research.
4. Excellent cooperative attitude of colleagues at San Angelo, College Station and Sonora interested in toxic plant research.

5. Good technical support staff at San Angelo.
6. Excellent cooperation from Texas Agricultural Extension Service specialists and County Extension Agents.

Weaknesses of the current program include:

1. Salaries too low at Research Associate and Technician levels, resulting in rapid turnover of key personnel.
2. Lack of restraint at Project Leader level has spread efforts over too many problem areas.
3. Inadequate laboratory space (to be alleviated with construction of new laboratory in 1982).
4. Lack of land resource used specifically for toxic plant management research.

Future Directions

We plan more emphasis on "range improvement systems" concept in field research on management of toxic plants, i.e. evaluate combinations of two or more complimentary approaches or techniques. Less emphasis on broadcast application of herbicides for toxic plant control due to increasing costs of herbicides and commercial application. More emphasis on less expensive methods for herbicide application in critical areas. More emphasis on improving forage quality by interseeding rangeland with shrubs such as fourwing saltbush as a method for reducing consumption of toxic plants by livestock.

We also plan to conduct field experiments to evaluate supplemental treatments for sheep grazing bitterweed infested range areas. Attempts will be made to coordinate this with work currently underway in the Department of Veterinary Physiology and Pharmacology at College Station. A study of the genetic and environmental aspects of bitterweed tolerance and adaption in sheep is also planned.

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MYCOTOXINS

General Objectives

Mycotoxins are metabolic products of ubiquitous molds. It is well established that mycotoxins cause animal and human diseases. We hypothesize that mycotoxins are also one of the important multicausal factors in a variety of diseases of undertermined origin. Thus mycotoxins are of great animal and public health interest.

A major objective of the Veterinary Public Health mycotoxicology research laboratory is to examine in detail such mechanisms. It is only by understanding the causal events leading to the lesion can the mechanism be established. Only by understanding the mechanism of toxicity can an intelligent approach to prevention of toxic hazards be developed. Moreover, frequent failure to evaluate the health implications of mycotoxins has resulted from a lack of sensitive and reliable diagnostic techniques for the identification of mycotoxins and their metabolites in animal and human tissues and biological fluids. Another major research objective of our laboratory is to develop such methodology for environmentally important mycotoxins utilizing high pressure liquid chromatography (HPLC), gas-liquid chromatography (GLC), and GLC/Mass spectrometry in order to establish critically needed early detection and diagnostic techniques. Concurrently, these methods are employed in studies designed to ascertain acute versus chronic distribution, elimination patterns and metabolic profiles in order to better understand toxin fate in a biological system and its mechanism(s) of toxicity.

Specific Research Goals

The specific aims of ongoing mycotoxin research in the Department of Veterinary Public Health are outlined as follows:

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[illegible] mycotoxins cause animal and human diseases. We hypothesized that [illegible]

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(HPLC), gas-liquid chromatography (GLC), and (c) mass spectrom[illegible]

to establish critically needed early detection and diagnostic [illegible]

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[illegible] in order to better understand toxin fate in a biological sys[illegible]

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1. To develop rapid, sensitive, and reliable analytical methodology for extraction, identification, and confirmation of the mycotoxins aflatoxin B_1, B_2, G_1, G_2, ochratoxin A, penicillic acid, citrinin, and zearalenone and associated major metabolites in tissues and biological fluids.
2. To apply methodology developed in determining receptor binding sites, histopathologic relationships, tissue and organ residual concentrations, biological half retention times, absorption from the gastrointestinal tract, excretion in the urine and feces, and time of maximal accumulation in blood and tissues, all of which represent data that will be useful in establishing mechanisms of toxic action of mycotoxins, either singly or in combination with other potentially synergistic toxins especially products of lipid autoxidation.
3. To develop a reproducible comparative laboratory animal model (rat) for impaired renal function to evaluate the etiopathogenesis of acute versus chronic exposure to the nephrotoxic mycotoxins, ochratoxin A and citrinin.
4. To determine the effects of mycotoxins *in vitro* and *in vivo* on high affinity receptor enzymes and on such parameters as electrogenic Na^+ transport across bioelectrically active membrane and to elucidate mode(s) of action through selective chemical derivatization.

Recent Research Accomplishments

1. Sensitive methods of analysis and confirmation of penicillic acid utilizing HPLC/GLC/GLC-Mass spectroscopy are currently being investigated in our laboratory. PA reacts with excess diazomethane to form a pyrazoline derivative (Py-PA) and our studies indicate that both PA and Py-PA could be analyzed by reverse phase HPLC using a mobile

phase of acetonitrile-water (60:40) and UV detection at 254 nm.

2. Derivatization of ochratoxin A may be useful in its detection and confirmation from tissues. OA reacts rapidly with diazomethane to form the O-methyl-ochratoxin A, methyl ester ($OA\text{-}Me_2$) and could be analyzed by reverse phase HPLC using a mobile phase of acetonitrile-water (60:40) and UV detection at 254 nm.
3. We have recently developed a method for determining PA residues in tissue. Acute oral dosing of chickens with PA over a range of 50-550 mg/kg body weight resulted in detectable levels of the mycotoxin (confirmed by gas liquid chromatography) in gizzard muscle and contents, liver, kidney, heart, and intestinal contents.
4. Studies have indicated that OA and PA are synergistic in combination in the mouse.
5. We have shown that mycotoxins which contain an unsaturated lactone are extremely reactive to exposed thiol receptors in membrane protein and may elicit a primary mode of toxicity through interaction at membrane and subcellular transport sites and disruption of transport and energy dependent respiratory processes. These effects can be prevented by pretreatment with sulfhydryl containing compounds.
6. We have developed a method for the analysis of aflatoxins B_1, B_2, G_1, G_2 and the metabolite M_1 using high pressure liquid chromatography and a radial compression separation system. Excellent resolution of aflatoxins from samples of human liver, serum, and urine was achieved using this technique and may prove useful in studies designed to determine the multicausal etiopathogenesis of Reyes syndrome in children.

Strengths and Weaknesses

The Department of Veterinary Public Health (TAMU) focuses its principle teaching and research activities in eight areas of public health which include: food and feed protection, epidemiology, animal control, preventive medicine, and laboratory animal medicine. Mycotoxicology is an important area of the food toxicology program in VPH and a commitment to research in mycotoxicology is a recognized priority in the Department.

The mycotoxicology laboratories of VPH are excellently equipped to sustain a vigorous research program in areas related to analytical methods development, mechanism(s) of action, metabolism and disposition, trace analysis, receptor binding, chemical derivatization-detoxification, etc. Achievement of this program is greatly aided by a well-established formal mechanism for exchange of technical information which exists between our laboratory (VPH) and the United States Department of Agriculture, ARS, Veterinary Toxicology and Entomology Research Laboratory (VTERL) at College Station, Texas. This technical liaison between VPH and VTERL is a day-to-day functional part of all VPH mycotoxicology research activities. This liaison includes a mutally beneficial access to highly specialized research equipment between both laboratories. VPH research efforts are also enhanced by collaborative mutually beneficial linkages with established investigators (pathologists, toxicologists, pharmacologists, epidemiologists, and statisticians) at Texas A&M University and around the country.

Our two major weaknesses are (1) a lack of adequate associate research staff (research assistants, fellowships, scholarships, technicians, etc.), and (2) a lack of appropriate recognition and reward of collaborative and outstanding individual efforts by reporting, recognizing, and rewarding achievements on the basis of allocation between cooperating units and on a "per SY" and "per investigator" basis.

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Future Directions

1. Interdisciplinary Collaboration - Mycotoxin research at Texas A&M will be further enhanced in the future by the active establishment of formal mechanisms for the exchange of technical information, and extensive interdisciplinary collaboration between departmental scientists within the College of Veterinary Medicine and the Medical School. Specific research targets will be identified as working foci. Research priorities will be in the direction of studies designed to develop key information essential to the understanding of whole animal response and molecular level events initiated by mycotoxins and evaluation of their implications to public health.
2. Veterinary Clinical Collaboration - Exploit veterinary diseases and veterinary hygiene inspection results as sentinels of mycotoxin diseases. Veterinary disease problems offer "natural" laboratory situations which are opportunities to study natural phenomena regarding mycotoxin - host interactions. Indeed, it was just this insight regarding the occurrence of turkey X disease which triggered awareness of the aflatoxin problems. For many years the veterinary literature has reported a number of heretofore apparently unrelated disease problems associated with consumption of moldy feed. Veterinary food hygiene inspections remain today as the most promising "natural laboratory" resource to discover and elucidate unknown interrelationships between disease phenomenon and mycotoxins.
3. Analytical Techniques - There is a need for definitive analytical techniques for use in scientific studies involving diseased tissues, mechanisms of action of the mycotoxins, the efficacy and pathways of detoxification, etc.

Collaboration Physician research

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4. Elucidation of Basic Mechanisms - The mechanisms of toxic action of mycotoxins at the molecular level needs elucidation if we are ever to hope to fully exploit these natural phenomena for the benefit of public health.

5. Nutritional Toxicology - Research into the role of nutrition in mycotoxin response by the individual and the population promises great rewards. It is generally recognized that a balanced diet is the best recommendation regarding preventive medicine to support resistance to these toxins. This fact underscores the potential health risks involved in consumption of "odd" diets. There is every reason to suspect that appropriately balanced nutrient intake is a potent preventive medicine factor in regard to resistance to any toxic component in foods. While there is no such thing as absolute safety in food, there is a great deal of effort currently directed towards achieving such an illusory goal through recommendations which involve poor nutrition practices. The study of nutrient-toxin interactions is perhaps the most promising field in nutrition when we consider the entire spectrum of food safety problems in a modern complex society. This field of study, which we have named "Nutritional-Toxicology" is undoubtedly the most promising and most underdeveloped discipline within the field of public health.

6. Inhibition of Formation - Inhibition of formation of mycotoxins needs to be studied so that food production and processing practices can be developed and applied to control these toxins.

7. Toxicity in Combination - The toxicity of mycotoxins in combination with one another and other toxins needs elucidation. In nature, these toxins are very likely to occur in combination. Special em-

phasis needs to be given to interactions between products of lipid autoxidation and mycotoxins.

8. Chronic Toxicity - Chronic exposure to mycotoxins is a common mode in nature. Long term, low level effects of these toxins needs study.
9. Derivative Toxicity - The toxicity of the derivative compounds of the mycotoxins needs further study.
10. Epidemiology - Surveys of food and feed as it is consumed in various societies needs to be performed to identify the incidence and prevalance of all the mycotoxins.
11. Detoxification - Methods to detoxify the mycotoxins in foods and feeds need further study in order to develop a practical, economical, and safe detoxification technique. This is especially true for those contaminations which occur in societies which cannot afford the loss of contaminated foods.

CELLULAR TOXICOLOGY

General Objectives

The Cellular Toxicology Research Unit at VTERL has the following broad goals: 1) to understand the effects of toxins on tissues, cells, and cell constituents through basic cytological research, 2) to use cellular and subcellular systems as models to predict and understand the effects of toxic substances on livestock, and 3) to develop ways of reducing the adverse effects of toxicants on livestock; i.e. to protect livestock from toxicants.

Specific Research Goals

The Unit's research program is oriented toward addressing a number of specific goals.

1. Determine the effects of toxicants and other agricultural chemicals on the cells and tissues of livestock and/or other model systems.
2. Develop new cell lines for use in the *in vitro* evaluation of the toxicity of agricultural chemicals.
3. Develop methods for investigating the effects of toxicants on the immune systems of livestock, particularly on the immune systems of the lung and other membrane-lined surfaces. Investigate effects of toxicants on macrophage function and on other cells of the bronchial lumen; e. g., secretory epithelial cells.
4. Investigate the absorption of lipid soluble toxicants from the digestive systems of sheep and determine their effects upon the immune system of sheep.

5. Determine how plant-derived toxicants affect the production of extracellular enzymes, cyclic nucleotide metabolism, and prostaglandin metabolism of alveolar macrophages.
6. Study the interrelationship between stress and toxicity of agricultural chemicals.
7. Develop reliable electron microscopical and cytochemical methods for use in evaluating the affect of toxicants and other naturally occurring or synthetic agricultural chemicals on the cells and tissues of livestock.

Recent Research Accomplishments

A novel assay of phagocytosis, luminol-dependent chemiluminescence was developed to show that kinetic analysis of phagocytosis by Lineweaver-Burk plots may be used to determine the effects of environmental pollutants and agricultural chemicals on alveolar macrophage function. The method is of practical significance for rapid identification of inhibitors of phagocytosis. The analysis has been shown to be a useful mathematical construct of phagocytosis because Vmax represents avidity of the cell surface (Fc receptor activity) and Km indicates the phagocytic capacity.

In vivo studies of plant toxicants have shown that components are present in extracts of cotton bract that act as inhibitors of luminol-dependent chemiluminescence by alveolar macrophages. Other studies have determined the effects of cotton extracts on histamine release by using a species of mouse which can be sensitized to histamine by pretreatment with bacterial endotoxins. These studies have become particularly relevant in regard to byssinosis, a respiratory disease of cotton mill employees.

Recent studies show that gossypol (a component of cotton seed) causes regression of some sarcomas in male, but not female, CFW mice. Recent studies have also shown that at least one juvenile hormone analog causes a permanent and lasting cessation of melanine secretion in cultured melanocytes even when applied at a relatively low concentration.

Ultrastructural studies of monensin-treated ponies show selective damage to diaphram and heart mitochondria indicating that these tissues may be primary targets of monensin toxicity. Tests on other cellular systems show that monensin may also affect carbohydrate secretion by selectively inhibiting Golgi apparatus.

Strengths and Weaknesses

The research scientists of the Cellular Toxicology Research Unit (CTRU) are dedicated individuals who labor industriously to produce a good research product. In addition, these scientists also willingly participate in cooperative projects both within, and outside of, the VTERL. The cooperative work is particularly important in this environment because of the limited staff and the severe restrictions on travel.

The facilities are adequate in reference to total space for the unit; however, the organization of this space is bad and much of it should not be used in its present configuration. This is particularly true of the isolation wing which houses the cell culture and small animal facilities. The cell culture rooms are inadequate and the animal facility does not meet the recommended GLP standards for animal care. The equipment available within the CTRU or VTERL is relatively good. However, it will be necessary to update some of the major pieces of equipment within the next several years and purchase additional equipment for program enhancement. For example, we need, or will

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need, new or additional equipment for measuring such parameters as oxygen consumption, chemiluminescence, heat generation (microcalorimeter), and enzyme content of small volumes of cells. Primarily we need to expand our capabilities for analyzing small volumes of cells and tissues.

The weakness of the Unit is primarily in "critical mass." That is, the staff is too small and of too diverse background to give really effective coverage in any area of research. A brief background regarding the origin of CTRU may be helpful in understanding the problem.

In 1977, the functions of VTERL were subdivided into six disciplines one of which was the Microbiology Research Unit (MRU--later to become the Cellular Toxicology Research Unit--CTRU). The MRU consisted of the three VTERL research scientists (Drs. Norman, Ziprin, Mollenhauer) then classified as microbiologists. In 1980, the name of the MRU was changed to Cellular Toxicology Research Unit (CTRU) to better reflect the research functions of the Unit. This was based upon two considerations: 1) the Unit did little or no work on, or with, microbial systems, and 2) the scientific staff of the Unit was so diverse that it required either a more appropriate title or a redefinition of the Unit's research endeavors. Also in 1980, the Unit acquired its fourth research scientist (Dr. Meola) by transfer from the Unit working with insects that affect livestock. Dr. Meola was classified as an entomologist and was transferred into the CTRU because of her work in electron microscopy. Dr. Meola is not currently engaged in toxicological work and, in fact, works under a WRU different from that of the rest of the Unit.

Future Directions

The primary objective is to develop greater strength in at least part of the CTRU program by the acquisition of additional staff. The initial

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strengthening would be in the cellular immunology part of the present program. This would include an expansion of the present *in vitro* work on the alveolar macrophage and on respiratory defense mechanisms, as well as, the *in vivo* work on chickens infested with the Northern Fowl Mite. The latter program, though currently very limited in scope, may eventually provide enough information for the development of a vaccine against the Northern Fowl Mite.

Though not classified as an official function, the CTRU nonetheless provides a significant service to other Research Units and to the National Cotton Pathology Research Laboratory, particularly in relation to electron microscopy and *in vitro* testing systems. These functions should be maintained and perhaps upgraded to provide additional and better quality of work.

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ENVIRONMENTAL TOXICOLOGY

General Objectives

There are presently more than 70,000 commercial chemicals in use and more than a thousand new compounds are synthesized each year, yet little is known regarding the biohazards associated with many of these chemicals. There is an increasing need to examine synthetic and naturally occurring chemicals for genotoxic, mutagenic, and carcinogenic potential. In addition, the manner in which these toxicants are biotransformed is important, as their mutagenicity and carcinogenicity may be altered by manipulation of hepatic and other drug metabolizing enzyme systems. The environmental toxicology program within the Department of Veterinary Physiology and Pharmacology, TAMU, has for several years been carried by a single scientist (Dr. Jones). Dr. Jones' research activity has focused on the identification of genotoxic synthetic and naturally occurring chemicals. However, the program will be considerably strengthened by the movement of Dr. Safe and his colleagues to TAMU from the University of Guelph. During the past 10 years, the major focus of Dr. Safe's research program has been centered on the chemistry, metabolism, biochemistry, toxicology and mechanism of action of the halogenated aromatic hydrocarbons. This group of chemicals includes the polychlorinated biphenyls (PCBs), benzenes (CBs), naphthalenes (PCNs), terphenyls (PCTs), dibenzo-*p*-dioxins (PCDDs), dibenzofurans (PCDFs), and polybrominated biphenyls (PBBs). Many of these compounds have been identified in the environment and in fish, wildlife, and human tissue. A major problem associated with the halogenated aromatics is that within each class of compounds there can be numerous isomers and congeners (e.g. 209 PBBs and PCBs) and any investigation on their toxic and biologic

effects must necessarily be dependent on a strong chemical foundation (synthetic and analytical). Utilizing capabilities in synthetic organic chemistry research has recently concentrated on the remarkable effects of structure on the biologic and toxic activities of halogenated aromatics and related compounds.

Specific Research Goals

Specific research goals of the environmental toxicology research program envisioned at TAMU include the following:

1. The identification of genotoxic synthetic and naturally occurring chemicals through the use of appropriate screens for mutagenicity.
2. The effects of structure on the activities of halogenated aromatics as inducers of the drug-metabolism enzymes in mammals with specific emphasis on the induction of the cytochrome P-450-dependent monoxygenases, epoxide hydrolase, and the phase II conjugating enzymes; and the effects of structure on the pharmacodynamics of halogenated aromatics _in vivo_.
3. The effects of structure on the toxic effects (thymic and splenic involution, teratogenicity and porphyrinogenicity) of halogenated aromatics in rodents including the genetically inbred C57Bl/6J and DBA/2J mice.
4. The mechanism of the toxic action of halogenated aromatics.
5. The biologic and toxic effects of reconstituted breast milk PCBs and halogenated hydrocarbons.
6. The effects of halogenated aromatics and halogenated aromatic induction on the toxicity and mutagenicity of specific procarcinogens to mammalian cells in culture.

7. The effects of PCBs on the *in vivo* activity of hepatocarcinogens in the formation of preneoplastic liver nodules (in collaboration with Dr. E. Farber, Department of Pathology, University of Toronto).
8. The development of bioassays for the detection and quantitation of toxic halogenated aromatics (e.g., 2,3,7,8-TCDD) in fly ash, waste disposal sites and commercial products.
9. Substituted halogenated biphenyls as probes for the induction of multiple forms of cytochrome P-450.
10. Reye's Syndrome - *in vivo* and *in vitro* model studies (in collaboration with Dr. J.F.S. Crocker, Department of Pediatrics, Dalhousie University).

Recent Research Accomplishments

Dr. Jones' research activity has focused on identifying genotoxic chemicals found in the environment. In the area of energy pollution, simulated coal slurry waters have been shown to be mutagenic in short term microbial assays. In addition, these slurry waters also induced hyperplastic liver nodules in rats which often given rise to hepatocellular carcinomas.

The annual loss of sheep and goats in Texas from *Hymenoxys odorata* (bitterweed) poisoning has been estimated to be in excess of $3.5 million. A number of sesquiterpene lactones have been tested for genotoxicity in several bacterial assays. The toxicity of one sesquiterpene lactone, hymenoxon, was successfully altered by manipulating hepatic enzymes.

The following papers have been submitted or published in 1980-81:

1. Herrig, B. W. and D. H. Jones. 1980. Utilization of the Escherichia coli pol A test: An adjunct to the Ames assay. Vet. Hum. Toxicol. 22(5):326-328.

2. Jones, D. H. and H. L. Kim. Accepted. Toxicity and mutagenicity of hymenoxon: A sesquiterpene lactone. Toxicol. Letters.
3. Jones, D. H. and H. L. Kim. 1981. Toxicity of hymenoxon in Swiss white mice following pretreatment with microsomal enzyme inducers, inhibitors and carbon tetrachloride. Res. Comm. Chem. Pathol. Pharmacol. 33(2):361-364.
4. Bowers, D. E., M. S. Cannon and D. H. Jones. Submitted. Untrastructural Changes in liver of young and aging rats exposed to methylated benzenes. Am. J. Vet. Res.
5. Jones, D. H., H. L. Kim and K. C. Donnelly. Accepted. DNA damaging effects of three sesquiterpene lactones in repair deficient mutants of Bacillus subtilis. Res. Comm. Chem. Pathol. and Pharmacol.

Most of Dr. Safe's recent research activity has focused on the effects of PCB (and PBB) structure on their activity as hepatic microsomal enzyme inducers. Additional research as yet unpublished has greatly extended knowledge in this area. An indicator of recent research activity and accomplishment is illustrated by recent papers submitted or published (1980-81) in refereed journals:

1. Parkinson, A., L. Robertson, L. Safe and S. Safe. 1980. Polychlorinated biphenyls as inducers of hepatic microsomal enzymes Structure-activity rules. Chem.-Biol. Interact. 30:271-285.
2. Sparling, J. and S. Safe. 1980. The pharmacokinetics of five hexachlorobiphenyl isomers which differ in their degree of ortho substitution in the rat. Chemosphere 9:129-137.
3. Sparling, J., D. Fung and S. Safe. 1980. Bromo and chlorobiphenyl metabolism: GC-MS identification of urinary metabolites and the effects of structure on their rates of excretion. Biomed. Mass Spectrom. 7:13-19.

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4. Parkinson, A., L. Copp and S. Safe. 1980. A comparison of the benzo[a]pyrene and 4-chlorobiphenyl hydroxylase enzyme assays in distinguishing between phenobarbitone- and 3-methylcholanthrene-induced microsomal monooxygenases. Anal. Biochem. 105:65-73.

5. Parkinson, A., S. H. Safe and R. Cockerline. 1980. Induction of both 3-methylcholanthrene and phenobarbitone-type microsomal enzyme activity by a single polychlorinated biphenyl isomer. Biochem. Pharmacol. 29:259-262.

6. Parkinson, A. and S. Safe. 1981. Aryl hydrocarbon hydroxylase and its relationship to the toxicity of halogenated aryl hydrocarbons. J. Toxicol. Environ. Chem. Rev. 4:1-45.

7. Bandiera, S., S. Safe and A. Okey. Submitted. Binding of polychlorinated biphenyls classified as either PB-, MC- or mixed-type inducers to cytosolic Ah receptor. Chem.-Biol. Interact.

8. Campbell, M. A., S. Bandiera, L. Robertson, A. Parkinson and S. Safe. Submitted. Octoachloronaphthalene induction of hepatic microsomal aryl hydrocarbon hydroxylase activity in the immature male rat. Toxicology.

9. Parkinson, A. and S. Safe. Submitted. The cytochrome P-450-mediated metabolism of biphenyl and the 4-halobiphenyls. Biochem. Pharmacol.

10. Cockerline, R., M. Shilling and S. Safe. 1981. Polychlorinated naphthalenes as hepatic microsomal enzyme inducers in the immature male rat. Gen. Pharmacol. 12:83-87.

11. Hutzinger, O., K. Olie, J.W.A. Lustenhouwer, A. B. Okey, S. Bandiera and S. Safe. 1981. Polychlorinated dibenzo-p-dioxins and dibenzofurans: A bioanalytical approach. Chemosphere 10:14-25.

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Safe. 1981. Polychlorinated dibenzo-p-dio[illegible]
[illegible]ans: A bioenergetical approach. Chemosphere [illegible].

12. Parkinson, A., L. Robertson, S. Bandiera, K. Riley and S. Safe. Submitted. Evidence that 2,3'4,4',5,5'-hexachlorobiphenyl is neither a phenobarbitone-type nor 3-methylcholanthrene-type inducer of rat hepatic microsomal cytochrome P-450. Chem.-Biol. Interact.

13. Parkinson, A., L. Robertson, L. Safe and S. Safe. 1981. Polychlorinated biphenyls as inducers of hepatic microsomal enzymes: Effects of diortho substitution. Chem.-Biol. Interact 35:1-12.

14. Robertson, L., A. Parkinson and S. Safe. 1981. Induction of drug-metabolizing enzymes by fractionated commercial PBBs. Toxicol. Appl. Pharmacol. 57:254-262.

15. Robertson, L., A. Parkinson, S. Bandiera and S. Safe. 1981. Potent induction of rat liver microsomal drug-metabolizing eyzmes by 2,3,3',4,4',5-hexabromobiphenyl, a component of firemaster. Chem.-Biol. Interact 35:13-24.

16. Mullin, M., G. Sawka, L. Safe, S. McCrindle and S. Safe. 1981. Synthesis of octa- and nonachlorobiphenyl isomers and congeners and their quantitation in commercial polychlorinated biphenyls and identification in human breast milk. J. Anal. Toxicol. 5:138-142.

Strengths and Weakness

Dr. Safe's toxicology research program is only now being transferred to Texas A&M University. Although this will result in a temporary disruption in research it is believed that this move will have strong positive effects for the following reasons:

1. The larger University community and the USDA Veterinary Toxicology Laboratory will facilitate research interactions, discussion, and collaboration.

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... A., L. Robertson, ... and S. Safe. 1981.
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ts of diortho substitution. Chem.-Biol. Interact. ...
son, L., A. Parkinson and S. Safe. 1981. Induction
... metabolizing enzymes by fractionated commercial PCBs. Toxicol.
... ol. 57:254-257.
on, L., A. Parkinson ... and S. Safe. 1981 ...
tion of rat liver microsomal ... monooxygenases ...
...,4',5-hexabromobiphenyl, a component of Firemaster ...
... tiol. Interact. 35 13-24.
... M., ... Safe, L. Safe ... and ... 1981
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... cation in human ... J. Anal. Toxicol. ...

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... toxicology research ... only now being ...
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2. The University commitment (financial) to our toxicology research will greatly improve the stability and effectiveness of our group.

The future strength of research in toxicology will depend on the establishment of an appropriate training program with funding for studentships and postdoctoral fellowships. In addition, a stronger core of excellent research scientists with external peer-evaluated funding must be recruited.

Future Directions

It is anticipated that future research activities of Dr. Jones will continue to involve short term microbial assays for genotoxicity. In addition, chemical toxicants will be examined for their tumor promoting capacity. With respect to Dr. Safe's program, most of the specific research goals noted above have not been fully developed and future directions for the next five to ten years will concentrate on these specific research areas.

TAMU RESEARCH TRAINING PROGRAM IN TOXICOLOGY

Program Objectives

The Toxicology Training Program is designed to prepare selected trainees for pursuit of a research, management and/or teaching career in toxicology. Training includes courses in industrial, environmental, food, analytical, molecular, diagnostic and experimental toxicology. Minors are selected in biochemistry, physiology, pharmacology or pathology. Upon completion of this program, trainees are prepared to accept positions in academic institutions, industrial organizations or governmental agencies. There is no subdivision of study within the degree. The opportunity does exist to select nontoxicology courses from other departments which are closely related and strengthen the program. Students are encouraged to concentrate their electives in chemistry, biochemistry, pharmacology and pathology.

1. The core courses required in veterinary toxicology for the Master of Science Degree:

   Bich. 603 (or equivalent) General Biochemistry I. Credit 3

   Bich. 604 (or equivalent) General Biochemistry II. Credit 3

   Stat. 651 Statistics in Research I. Credit 3

   VPP 605 Toxicology. Credit 4

   VPP 606 Toxicology. Credit 4

   VPP 631 Instrumentation in Toxicological Analysis. Credit 4

   VPP 632 Metabolic and Detoxication Mechanisms. Credit 3

   VPP 681 Seminar. Credit 1

2. The core courses required in toxicology for the Ph.D. degree if bypassing the M.S. degree:

Bich 603 General Biochemistry I. Credit 3

Bich 604 General Biochemistry II. Credit 3

Stat 651 Statistics in Research I. Credit 3

Stat 652 Statistics in Research II. Credit 3

VPat 601 Basic Pathology. Credit 4

VPH 618 Food Toxicology. Credit 3

VPP 607 Pharmacology. Credit 4

VPP 608 Systems Pharmacology. Credit 4

VPP 627 Toxicology. Credit 4

VPP 628 Toxicity Testing Concepts. Credit 3

VPP 631 Instrumentation in Toxicological Analysis. Credit 4

VPP 632 Metabolic and Detoxication Mechanisms. Credit 4

VPP 633 Natural Products Toxicology. Credit 3

VPP 639 Genetic and Molecular Toxicology. Credit 3

3. List of supporting course work:

Bich 624 Proteins and Enzymes. Credit 3

Bich 630 Current Topics in Metabolism. Credit 2

Biph 621 Interpretation of Organic Mass Spectra. Credit 3

Biph 626 Radioisotopes Techniques. Credit 3

Biol 602 Transmission Electron Microscopy. Credit 5

Biol 651 Mycology. Credit 4

Chem 610 Organic Reactions. Credit 3

Chem 635 Heterocyclic Compounds. Credit 3

Ento 619 Insect Toxicology. Credit 4

SEng 680 Industrial Hygiene. Credit 3

VA 602 Histology. Credit 4

VMi 649 Immunology. Credit 4

VPat 640 Mechanisms of Disease. Credit 3

VPat 641 Systemic Pathology. Credit 4

VPP 624 Surgery for Physiologists. Credit 4

VPP 625 Physiological Measurements. Credit 4

VPP 626 Bionucleonics. Credit 4

VPP 689 Environmental Toxicology. Credit 3

4. TYPICAL PROGRAM OUTLINES FOR GRADUATE STUDENTS IN TOXICOLOGY

a. Master of Science Degree in Veterinary Toxicology:

Bich	603	General Biochemistry I	3
Bich	604	General Biochemistry II	3
Stat	651	Statistics in Research I	3
VPP	627	Toxicology	4
VPP	628	Toxicity Testing Concepts	3
VPP	631	Instrumentation in Toxicological Analysis	4
VPP	632	Metabolism and Detoxication Mechanisms	3
VPP	681	Seminar	1
VPP	685	Problems	4
VPP	691	Research	8
Electives from supporting courses			8
		Total	44 SCH

b. Ph.D. Degree Program in Veterinary Toxicology (bypassing the M.S. degree):

Bich	603	General Biochemistry I	3
Bich	604	General Biochemistry II	3
Stat	651	Statistics in Research I	3
Stat	652	Statistics in Research II	3
VPat	601	General Pathology	4
VPH	618	Food Toxicology	3
VPP	607	Pharmacology	4
VPP	608	Systems Pharmacology	4
VPP	627	Toxicology	4
VPP	628	Toxicity Testing Concepts	3
VPP	629	Toxic Plants and Biotoxins	3
VPP	631	Instrumentation in Toxicological Analysis	4
VPP	632	Metabolic and Detoxication Mechanisms	3
VPP	633	Natural Products Toxicology	3
VPP	639	Genetic and Molecular Toxicology	3
VPP	681	Seminar	2
VPP	685	Problems	4
VPP	691	Research	27
Electives from supporting courses			16
		Total	99 SCH

5. THE PRINCIPAL REQUIREMENTS FOR PROGRAM COMPLETION.

a. Number of credit hours (delineate regular course work, research, internship, other).

	Course work	Research	Other	Total
Master's Degree	36	8	4	48 SCH
Ph.D. Degree	68	27	4	99 SCH

b. A preliminary written examination is required for Ph.D.

c. A preliminary oral examination is required for Ph.D.

d. There is no internship requirement.

e. There is no departmental requirement for foreign languages. These are considered in the same status as other supplementary areas of study, to be included when indicated by the individual needs of students.

f. Research competency is required for both the M.S. and Ph.D. degrees. It is essential that the dissertation documents the ability of the candidate to perform substantive, original research.

g. A formal dissertation or thesis is required.

h. A final oral examination is required for both the M.S. and Ph.D. degrees.

i. Preparation of scientific publications is encouraged.

CHEMISTRY AND METABOLISM

Three of the four locations under the scope of this review maintain strong programs in chemical research on livestock poisons. Certain of the research programs at TAMU, Logan, and VTERL are targeted specifically upon the chemistry of livestock plant poisons, and some of the VTERL research additionally is concerned with the metabolism and residue chemistry in food producing animals of pesticides and other environmental pollutants.

TAES

General Objectives

Within the Department of Veterinary Physiology and Pharmacology, TAMU, two scientists (Drs. Camp and Kim) maintain active research programs related to the chemistry of livestock plant poisons. Objectives of this research can be summarized as follows:

1. The isolation and characterization of the toxic agents of the major livetock plant poisons of Texas.
2. The definition of the biochemical and physiological modes of action of these toxic agents.
3. The development of antidotes or other prophylactic measures to minimize livestock losses to these toxic plants.

Specific Research Goals

These can be summarized as follows:

1. Identify the toxic agent(s) associated with Fescue grass.

chemical research on livestock poisons. [illegible]

[illegible], TAES, Logan, and VTEL are the major specialists in the [illegible]

of plant poisons, and some of the VTEL's research

concerned with the metabolism and residue chemistry of [illegible]

pesticides and other environmental pollutants.

Department of Veterinary Physiology and Pharmacology, TAMU, [illegible]

[illegible] and Kim) maintain an active research program related to live-

stock plant poisons. Objectives of this research can be [illegible]

follows:

[illegible]ation and characterization of the toxic agents of the major [illegible]

poisons of Texas.

[illegible] of the biochemical and physiological modes of action of [illegible]

toxic agents.

[illegible]lopment of antidotes or other prophylactic measures to [illegible]

livestock losses to these toxic plants.

2. Develop HPLC methods for the alkaloids of Fescue grass.
3. Study the cardiovascular effects on the bovine of halostychine present in Fescue grass.
4. Establish the toxic principle(s) of Kleingrass.
5. Determine the effects of sporidesmin on the mixed-function oxidase system of the rabbit.
6. The seed of Sesbania species which is lethal to cattle contains toxic and antileukemic compounds. Attempts are underway to isolate the toxic principles.
7. Lobelia berlandieri is a poisonous plant which causes sporadic but heavy losses of cattle during certain years. Attempts are underway to isolate the toxic principle(s).
8. Cardiotoxic properties of helenalin and tenulin, sesquiterpene lactones, have been known for some time. The cardiotoxic effects of some other sesquiterpene lactones, including synthetic compounds, will be examined.
9. Two antioxidants, butylated hydroxyanisole (BHA) and ethoxyquine (EQ), are known to increase hepatic sulfhydryls in rats and mice. Toxicants such as sesquiterpene lactones are alkylating agents that bind rapidly with sulfhydryl groups in vivo. Other toxicants such as pyrrolizidine alkaloids are known to be activated to toxic alkylating agents in vivo. The toxicity of hymenoxon, a toxic sesquiterpene lactone isolated from bitterweed, and of pyrrolizidine alkaloids isolated from Senecio longilobus, was reduced in BHA or EQ pretreated mice. This concept will be expanded in the study of other toxicants such as aflatoxins and other mycotoxins.

10. A more effective glutathione inducer, 2-tert-butyl-4-hydroxyanisole, will be synthesized and its antidotal effects in several animal species will be examined.

Recent Research Accomplishments

The following are examples of recent research accomplishments.

1. A gas-liquid chromatographic method has been developed for the analysis of halostychine in Fescue grass.
2. A mycotoxin has been isolated from *Phomopsis* spp.
3. Hymenoxon, a toxic sesquiterpene lactone, was isolated from *Hymenoxys odorata* DC. (bitterweed) and its structure was determined including the relative stereochemistry by x-ray diffraction methods. Toxicity of hymenoxon and its derivatives were determined. Hymenoxon toxicity in sheep and dogs was prevented by L-cysteine when injected simultaneously or immediately following hymenoxon. Hymenoxon toxicity in mice was also prevented by feeding butylated hydroxyanisole (BHA) or ethoxyquine (EQ) in the diet. BHA pretreatment also prevented the acute toxicity of bitterweed in sheep.
4. Four metabolites of hymenoxon were isolated from urine of bitterweed-fed sheep and one of them was characterized by high resolution nmr spectra.
5. A toxic extract was prepared from *Lobelia berlandieri*, an annual plant which causes occassional heavy losses of cattle. The toxic extract caused myocardial damage in mice and dogs and lowered the blood pressure in the dogs. Two alkaloids in this extract were tentatively identified as piperidine derivatives based on the mass spectral data.

6. A toxic and antileukemic extract was prepared from *Sesbania vesicaria* seed. The oral, lethal dose in rabbits was about 30 mg/kg and for antileukemic activity in mice, a T/C value of 150 was found with 2 mg/kg/day doses *in vivo*.

Strengths and Weaknesses

The toxic plants chemistry program at TAMU currently has excellent technical support and a good pool of graduate students interested in this area of research. The available facilities, staff, and the current level of budgetary support are sufficient to maintain a viable program in chemistry oriented toxic plants research; however, the following steps would help to improve productivity:

1. Updating and/or replacement of some instrumentation that has become outdated.
2. Acquisition of new instrumentation, particularly in-house mass spectroscopy facilities, to better facilitate research.
3. Acquisition of more laboratory space specifically designed for chemical studies.
4. Better interaction and cooperation among existing staff of separate units within TAMU and USDA.

Future Directions

It is anticipated that isolations and characterizations of plant toxicants will be continued and hopefully expanded with the increased enrollment of graduate students and the availability of better instrumentation. Metabolic

studies, *in vitro* and *in vivo*, of known toxicants and their analogs will be expanded. It is also expected that greater emphasis will be placed in future research upon the chemistry of mycotoxins that may affect animal health or that may occur in agricultural products.

VTERL

General Objectives

The Chemical-Animal Interactions Research Unit at VTERL is comprised of 5 scientists, including the Research Leader. The research conducted within the Unit deals with the interactions of toxicants with food producing animals, with the goal of producing research data that will lead to reduced losses to the producer and reduced contamination of meat and other animal products reaching the consumer. General objectives of the research program are to:

1. Determine the mechanisms by which chemicals exert their toxic effects and are metabolized and excreted from the body.
2. Determine the nature and toxicity of the decomposition products of pesticides and other environmental toxicants that are formed in soil, water, and forage.
3. Develop analytical methods for the quantitation of pesticide residues, drugs, and other toxicants in meat, milk, and eggs and to conduct studies as appropriate to insure that actual or proposed uses of pesticides and animal drugs do not result in excessive residues in animal products.
4. Conduct studies as outlined under 1-3 above to support registration of pesticides and drugs for minor uses on livestock and poultry.

5. Develop methods to prevent or alleviate the toxic effects of foreign compounds to livestock and poultry and to minimize the accumulation or enhance the elimination of the compounds from the body.
6. Determine the chemical nature of the active constituents from poisonous range plants of economic importance to livestock producers, develop where possible effective antidotal procedures for treatment of poisoning, and evaluate whether these plant toxins pose a potential health hazard to humans through the consumption of contaminated meat or by-products.

Specific Research Goals

The five scientists within the Unit (Beier, Elissalde, Clark, Ivey, Ivie) are currently involved in a number of research areas within the focus of the Unit's mission. The following are some specific areas of research (planned or underway) that illustrates the research thrusts of the Unit:

1. Quantitate residues of methoxychlor in milk of cattle after dermal spray. Methoxychlor is still one of the most desirable chemicals for insect control on livestock, and these studies will evaluate its suitability for a new use.
2. Evaluate the nutritional significance of epoxide-reducing enzymes in the rumen. Epoxide reduction in the rumen--first defined in our laboratory-- may have considerable toxicological and nutritional implications.
3. Quantitate residues in eggs of laying hens treated with carbaryl and other miticides by dipping. Dipping with these miticides for northern fowl mite control requires full residue data.

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s on livestock and poultry and to minimize the accumulation [illegible]
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4. Evaluate metabolic and residual fate of the synthetic pyrethroid resmethrin in cattle and poultry. This highly efficacious and selective insecticide needs detailed study to evaluate safety.
5. Evaluate the furocoumarin chemistry of *Thamnosma texana*. This weed is a livestock photosensitizer, and furocoumarins are probably the causative agents.
6. Isolate lacinilenes and their precursors from cotton dust to permit studies of their toxicological significance. These chemicals may be causative agents of byssinosis.
7. Undertake carbon-13 NMR analysis of anomeric configuration and structure of arabino- and ribo-pyranosides and furanosides. Successful studies would provide excellent means for identifying these potentially toxic metabolites in animal systems.
8. Determine residues in tissues and urine of cattle treated with the herbicide triclopyr. Such studies are required in safety evaluation of this new herbicide.
9. Develop a model system for evaluating the effects of environmental chemicals on mammalian learning and behavior. Such tests could provide means of detecting adverse effects of such chemicals that are presently detectable by no other procedure.
10. Develop meaningful bioassays to aide in the elucidation of causative agents of byssinosis and other respiratory disorders.
11. Evaluate roles of the lymphatic system in pesticide absorption and transport in ruminants.
12. Develop methods for non-invasive *in vivo* evaluation of mixed function oxidase (MFO) activity in sheep. MFO's are enzymes responsible for biotransformation of foreign compounds and success in these efforts will allow evaluating their activity in normal or poisoned livestock.

Recent Research Accomplishments

1. The plant growth regulator mefluidide has been shown not to accumulate in tissues and it is not secreted into the milk to any appreciable extent after oral treatment of dairy cattle.
2. Treatment of cattle with boluses containing the insect growth regulator, methoprene, resulted in very minimal residue accumulation in tissues. Methoprene used as a bolus for fly control will thus not likely result in a toxicological hazard to humans.
3. Studies on the ruminant metabolism and environmental chemistry of the highy efficacious organophosphate insecticide, RH-0994, have shown that it is highly biodegradable.
4. Studies in rats treated orally with hexachlorobenzene and subsequently subjected to various stressing agents have shown that HCB-treated animals are much less capable of handling stress without deleterious effects.
5. A simple, rapid fat biopsy technique has been developed for poultry that allows sequential sampling for pesticide residue analysis on the same bird with no apparent adverse side effects.
6. A method has been developed for the isolation and stimulation of mammalian mast cells, which may lead to an accurate assay for acute respiratory symptoms associated with byssinosis.
7. Residue analyses of eggs from hens dipped with a stirofos formulation to control the northern fowl mite have shown that residues are well below established tolerances.
8. Phototoxic and photocarcinogenic psoralens have been isolated from the root of parsnip, a widely consumed human food.

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9. Studies with the garden carrot have shown that this important human foodstuff does not contain psoralens or, if present, they are at very low (sub-ppm) concentrations.
10. A novel chromatographic approach has been developed to allow a more detailed study of potentially toxic fractions from the cotton plant.
11. Rats fed hexachlorobenzene exhibited marked differences in their capacity to metabolize and excrete other pesticides, when compared to normal, non-HCB treated controls.
12. Chlorpyrifos (Dursban) treatment of sheep for sheep ked control did not result in excessive residues of either chlorpyrifos or its pyridinol metabolite.
13. Studies with the synthetic pyrethroid, permethrin in lactating goats has resulted in the delineation of its metabolic fate in these ruminants. Twenty-six permethrin metabolites were fully or partly characterized.

Strengths and Weaknesses

The Unit is blessed with modern, well-kept laboratory facilities that are fully adequate to meet our needs for the forseeable future. For the most part, in-house chemical instrumentation is fully adequate to meet our needs, with the noticeable exception that our 8-year old GLC/mass spectrometer system needs replacement. An additional serious need is to upgrade our presently inadequate facilities for studies of radioisotopes in large animals. Within the past 2 years, mechanisms have been established to permit and encourage TAMU students to do their graduate research in the Unit. Currently, 6 students are working out of this lab for all or part of their research projects, and this has created a very stimulating scientific environment. Relations with TAMU faculty

researchers is generally excellent, and cooperative projects are underway with representatives of at least 4 TAMU Departments.

The current level of funding is barely adequate to maintain the research program as is. Personnel ceilings are of such severity that permanent personnel, once lost, cannot be replaced. This has resulted in our Unit of 5 scientists having no permanent technical support people. However, the availability of excellent graduate students has gone a long way to offset the negative impacts of hiring freezes.

Future Directions

We believe that, given the scientific diversity of the professionals within the Unit and the broad mission of the group, our research thrusts are fully on target and we see no reason for major shifts in emphasis. We feel, as we have for many years, that we do need better communication with action and regulatory agencies so that our research can be targeted more toward problems of critical importance in animal protection and food safety. We plan to continue our strong emphasis on research aimed at supporting minor use registrations of pesticides and drugs on livestock and poultry.

LOGAN

Objectives and Goals

Part of the research effort at Logan has for many years been directed toward chemical aspects of poisonous plants, particularly plants occurring in the more western range states of the United States. Specific objectives and goals of this plant chemistry program are as follows:

1. Identify toxic and teratogenic principles of poisonous plants.
2. Determine the mechanism of action of plant toxins and teratogens.
3. Develop methods to prevent deleterious effects of plant toxins and teratogens in livestock through information about active principles.
4. Study the physiology and biochemistry of poisonous plants.
5. Identify hazardous plants proposed for introduction through chemical analysis and intercept them before introduction.
6. Determine fluctuations in alkaloid content of range plants, factors that influence variations, and factors influencing toxicity and metabolism in livestock.

Examples of Research Progress

Certain of the recent research accomplishments of the chemistry group at Logan are discussed in the "Toxic Plants" section of this document. These and other accomplishments are discussed below in somewhat more detail.

1. Steroidal alkaloids that are responsible for naturally occurring monkey face lamb disease were isolated and structurally elucidated from *Veratrum californicum*. Structural and configurational features essential for teratogenicity were determined. Requirements include a basic nitrogen in ring E configurationally α to the steroid plane, with the degree of α projection influencing relative teratogenicity. Steroidal alkaloids from other food and feed sources were examined for teratogenicity. Results allow prediction of teratogenic hazard of steroidal alkaloids from natural sources. Variability in expression of teratogenicity of steroid teratogens among mouse genotypes, and effects in embryo culture have provided information on mechanism of action.

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2. Quinolizidine alkaloids from *Lupinus* spp. responsible for crooked calf disease were identified. Their concentration in plants as a function of growth stage was elucidated. The concentration data and the known gestational hazard period has allowed development of a management method that reduces disease incidence to about 1/10 that in non-managed situations.
3. Lupins used as food from the Mediterranean and South American areas have been examined by GC/MS analysis for possible teratogenic hazard. Results suggest that while toxic alkaloids are variably present in various cultivars in use, no detectable level of teratogenic alkaloids is found.
4. Studies on the minimum structural requirements for teratogenicity among piperidine alkaloids have suggested ring and side chain essential features. The ring cannot be fully unsaturated nor can the side chain α to the nitrogen be shorter than propyl in length or bulk. Comparative teratogenicity and toxicity of one of these piperidines, coniine, has been studied in sheep, cows, and horses.
5. The piperidine alkaloid anabasine has been isolated and identified in highly teratogenic *Nicotiana glauca*. It represents about 99% of all alkaloid present. We believe it is responsible for the teratogenic affects produced by both *Nicotiana glauca* and also common tobacco, *Nicotiana tabacum* based on what we have learned about minimum structural requirements for teratogenicity among piperidine alkaloids.
6. The etiology of spontaneous hemorrhagic necrosis, a birth defect disease of hamsters, has been elucidated. We have shown it is a

[illegible] alkaloids from *lupinus* spp. responsible for crooked calf [illegible] identified. Their concentrations in plants as a function [illegible] was elucidated. The concentration data and the known hazard period has allowed development of a management [illegible] reduces disease incidence to about 1/10 that in [illegible] situations.

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Vitamin E responsive disease whose severity varies among hamster strain. Through Vitamin E supplementation this disease can be eliminated.

7. An NMR method for determining pyrrolizidine alkaloid (PA) content and composition of range plants was developed. PA content of six species from around the U.S. was measured as a function of growth stage. The tolerance of cattle to Senecio douglasii, var. longilobus and to S. riddellii was determined and correlated with the relationship of free alkaloid and N-oxide to conversion to toxic pyrroles.
8. Mouse assay demonstrated a significant difference in toxicity among Delphinium species which was not always correlated with total alkaloid content. Since individual alkaloids have been reported to vary in toxicity, a cooperative project was undertaken to isolate, identify, and measure toxicity of individual alkaloids of Delphinium glaucescens. Nine known and 5 new C_{19} diterpenoid alkaloids were identified. The major alkaloids were isolated in sufficient quantity for toxicity testing.
9. Sicklepod milkvetch (Astragalus falcatus), a nitro-bearing introduced species, has been identified as a poisonous plant. Miserotoxin has been shown to be the toxic compound in Astragalus michauxii, a poisonous plant of the southeastern United States. Miserotoxin has been similarly identified as the poisonous compound in Astragalus emoryanus, a species that causes serious losses of sheep and cattle in Texas and New Mexico. Saponins were isolated as the toxic compounds in alfombrilla (Drymaria arenarioides). Soluble oxalates and nitrates have been shown to be the toxic compounds in Galenia pubescens. Over 2,200 species of Astragalus have been

analyzed for nitro compounds and results have been published which included 225 nitro-bearing foreign species. The types of nitro compounds occurring in Astragalus have been measured and a chemotaxonomic study on the genus has been completed. The nitro compounds occurring in over 60 species of Indigofera has been identified.

DIAGNOSTICS IN VETERINARY TOXICOLOGY

General Objectives

Texas Veterinary Medical Diagnostic Laboratory is a service organization, funded separately by the legislature, which functions to provide full diagnostic services to the veterinary community. Research activities are necessarily secondary to service responsibilities and are of an applied nature. The research programs are primarily directed at improving diagnostic capabilities through developing new methods in analytical toxicology, investigating toxicity and active principles of poisonous plants, and studying modes of action and metabolism of various toxic chemicals.

Specific Research Goals

Current Programs

1. Ethylene glycol - We are studying the metabolism of ethylene glycol in dogs with the objectives of developing a new diagnostic method to detect poisoning by measuring glycolic acid in serum and urine using HPLC and GC/MS, establishing the kinetics of glycolic acid formation, and preventing ethylene glycol toxicity by metabolically blocking glycolic acid synthesis.
2. Lobelia - We are attempting to elucidate the structures of alkaloids in the toxic plant _Lobelia berlandieri_ and to identify the urinary metabolites of these alkaloids in ruminants using GC/MS. We are working with Dr. H. L. Kim of VPP on this project.
3. Rumensin (Monensin) - We are developing an improved method for determining Rumensin in feed and stomach contents using HPLC. This compound is hazardous to horses so the assay will have toxicologic as well as regulatory significance.

Medical Diagnostic Laboratory is a service organ [illegible]

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[illegible] ing new methods in analytical toxicology, investigating toxi-

[illegible] principles of poisonous plants, and study of modes of action

[illegible] various toxic chemicals.

[illegible] glycol - We are studying the metabolism of ethylene g [illegible]

[illegible] s with the objectives of developing a new diagnostic method [illegible]

[illegible] t poisoning by measuring glycolic acid in serum and urine using

[illegible] GC/MS, establishing the kinetics of glycolic acid formation,

[illegible] ting ethylene glycol toxicity by metabolically blocking

[illegible] acid synthesis.

[illegible] We [illegible] re attempting to [illegible] ucidate the structures of alkaloids

[illegible] ese alkaloids in [illegible]

[illegible] . H. L. Kim of TPP on this project.

[illegible]) - We are developing an improved method for deter-

[illegible] l and [illegible] t [illegible] rt contents using HPLC. This com-

Recent Research Accomplishments

1. An HPLC method for the determination of vitamin D_3 in livestock feed supplements was developed.
2. A study of the toxicity and excretion of cantharidin (blister beetle toxin) in various species was completed. New methodology for determining this compound in biological samples was developed using HPLC and GC/MS.
3. A method using HPLC and GC/MS was developed for sodium fluoroacetate (compound 1080) in baits and gastric content.

Strengths and Weaknesses

The strengths of this organization include a relatively well-equipped laboratory, and access to field toxicity situations in which new methods can be realistically evaluated and a perspective can be obtained into which problems we should address. Weaknesses are that service responsibilities are so heavy that research activities are often suspended. Manpower shortages prevent us from pursuing more programs.

Future Directions

We plan to expand our toxic plant research and to begin some programs in mycotoxins. Method development and evaluation will continue. Hopefully, we will increase our graduate student staff.

FACILITIES

USDA--COLLEGE STATION

The 55 acre VTERL complex is located northwest of and adjacent to the Texas A&M University campus. There are 21 buildings comprising the facility and approximately 20 acres of pasture for livestock grazing. Research efforts at VTERL include toxicology as related to food producing animals, biocontrol, and biochemistry and physiology of livestock arthropod pests. The facilities are designed to adequately support toxicological and entomological studies.

The main building (Building 1) houses most of the scientific personnel, basic research laboratories, and major instrumentation. The laboratory consists of 5 separate research units, 3 of which, the Veterinary Toxicology Research Unit, the Cellular Toxicology Research Unit, and the Chemical-Animal Interactions Research Unit are charged with the toxicological research efforts at the laboratory.

The Veterinary Toxicology Research Unit consists of laboratory space, large animal facilities and poultry facilities. The laboratory space includes clinical pathology and pathology laboratories as well as 5 smaller general purpose laboratories for handling of chemicals and specimens. Major laboratory support instrumentation includes: autoanalyzer for blood chemistry, particle counter, atomic absorption spectrophotometer, autotechnicon for pathology slides, light microscopes, centrifuges, balances, ultra-cold freezers, physiological recorders and on-line electrophysiological data acquisition equipment. Post mortem facilities and incinerators are adequate for examination and disposal of research animals. In addition, animal weighing scales and ancillary equipment are adequate for required large animal care. The large animal facilities include buildings (10,000 sq. ft.) for acute

toxicologic studies, outside pens (15,000 sq. ft.) for chronic toxicologic studies, a large animal surgery unit, and feed storage buildings (4,000 sq. ft.). Approximately 20 acres are subdivided into small lots for pasturing animals, and a nearby (about 10 miles) 400 acre leased ranch is used to hold animals between studies. The poultry facilities include 2 buildings (5,000 sq. ft.) for housing poultry and a feed mixing building. One additional building will be remodeled to allow chemical testing in northern fowl mite research. Sufficient laboratory space is included in each building for handling chemicals and specimens.

The Cellular Toxicology Research Unit consists of 3 relatively autonomous subunits: a scanning electron microscopy facility, a transmission electron microscopy facility. These facilities are all located in the main VTERL building. In addition, there is a limited space available for the maintenance and study of small animals.

The Chemical-Animal Interactions Research Unit is located in the main VTERL building. Four large laboratory rooms for chemical research radiate off a centrally-located instrument room designed specifically for major equipment. In addition, one of the scientists in the Unit (Dr. Elissalde) occupies laboratory facilities in the isolation wing of the main building. The available large animal facilities in close proximity to the main laboratories are fully adequate for current and projected needs, with a noticeable exception of presently inadequate facilities for study of radioisotopes in large animals.

The major laboratories themselves are spacious, modern, well kept, and are fully adequate to support a considerable growth in chemically-oriented research. Major instrumentation available to the unit includes those for GLC/mass spectroscopy, FT-NMR (housed in an adjacent laboratory), infrared

spectroscopy, excellent GLC and HPLC facilities, liquid and crystal scintillation counters, and a fully adequate array of support equipment including centrifuges, homogenizers, evaporators, balances, hoods, etc.

TAMU/TAES - COLLEGE STATION

University Facilities

The new 12 million dollar addition to the Cushing Memorial-Sterling Evans Libraries was recently completed. The university library has more than one million volumes and subscribes to over 15,000 serial publications of which approximately 10% are concerned directly or indirectly to toxicology or courses that are available to this program. The Medical Sciences Library located at the College of Veterinary Medicine serves both human and veterinary medicine faculties and students. This specialized library has over 36,000 volumes and subscribes to over 1000 periodicals. A nine million dollar building is scheduled to house this growing collection and service facilities. Medline and OCLC services are available at both libraries. Two on-line search services which relate specifically to this training program are Toxline and Toxicology Data Bank. These combined resources and services provide more than adequate library resources.

VETERINARY PHYSIOLOGY AND PHARMACOLOGY

1. Facilities - The total space for the activities of the Department of Veterinary Physiology and Pharmacology is approximately 37,723 square feet. This includes 17,713 square feet in the Veterinary Sciences Building, 7,000 square feet in the Veterinary Administration Building, 1,530 square feet in the Large Animal Physiology Laboratory, 2,000 square feet on the Veterinary Research Farm, and 8,580 square feet in the Experimental Physiology-Toxicology Building. The latter facility is unique in that it was designed to house graduate students and their research. It provides space for conducting experimental surgery and clinical chemistry and holding pens for acute and chronic animal

experiments. Plans have been developed for modification and remodeling of the 3rd floor of the Veterinary Medical Administration Building to accommodate the anticipated growth in the program. These facilities will be devoted primarily to molecular and biochemical studies.

Texas A&M University has certain centralized facilities that can be utilized by graduate students in this program. These include the Nuclear Science Center, Data Processing Center, Activation Analysis Laboratory, Cyclotron Center, and Mass Spectrometer Laboratory.

A new laboratory animal and research facility central to the Medical and Veterinary Colleges has just been completed. It has 70,000 square feet of floor space and various supporting laboratories for surgery, clinical chemistry and biohazards. Construction of a new 11.6 million dollar veterinary clinical hospital and research facility will be completed April, 1981. This will provide additional laboratory equipment and space to this program.

2. Equipment - Thirty-three (33) Physiologic Recorders, complete with appropriate transducers and accessories
Liquid Scintillation Spectrometer
Gamma Ray Counting System
Multipurpose Radioisotope Scanner and Gamma Camera
Calculators (8)
Technicon Autoanalyzer with manifolds for most clinical chemistry determinations
Fifteen (15) Spectrophotometers
Five (5) Flame Photometers
Numerous microscopes (40)
Ten (10) Respirometers
Sixteen (16) Balances of various types
Autoclaves
Electromyograph consol with tape deck
Twenty (20) Centrifuges of various types
Twenty-six (26) Waterbaths
Analytrol (Beckman)
Three (3) Gas Chromatographs
Atomic Absorption Spectrophotometer (2)
Fluroscope with image intensifier
Waters, Prep LC System 500

Waters, Model 6000 Analytical High Pressure Liquid Chromatograph (2)
Microconcentrator L-UF-1
Cardiac Gait
Computer Terminal (3)
Ultrasonic Homogenizer
Incubator Forma Model 3157
8 channel tape recorders (2)
Brush Physiologic Recorders (3)
Centrifuge, Refrigerated (3)
Blood-Gas Analyzers (3)
Scintillation Cameras (2)
Fluorometers (3)
Scanner Systems (2)
Densitometers (2)
Amino Acid Spectrophotometer
Ultracentrifuge, Beckman
PDP 11/34 Computer
Spectroflurophotometer
Infrared Spectrophotometer
Ultra violet and visible spectrophotometers (2)
Fluorescent spectrophotometers (2)
Pelleting mill
Hammer mills (2)

The following instruments are in place or on order and will be available in September or October, 1981:

Centrifuges (Beckman J2-21, L5-50B, L8-70), Scintillation Counter (Beckman 1S-7000), Spectrophotometer (Beckman DU-8), as well as gas chromatographs with both packed and capillary columns and FID and ED detectors. All of these items will be located in Rooms B027 or 2059, Veterinry Clinical Sciences Building.

VETERINARY PUBLIC HEALTH

1. Facilities - The laboratories of the Department of Veterinary Public Health (VPH) , Texas A&M University, are located in an area formerly occupied by the Small Animal Clinic. This space has 2,100 square feet of lab area divided into nine rooms.

2. Equipment - High pressure liquid chromatograph
Gas chromatograph (TC, FID)
U.V. - visible scanning spectrophotometer

Liquid scintillation counter
High speed refrigerated centrifuge
Ultracentrifuge
Differential respirometers
Short-circuit current apparatus
Freeze dehydrator
TLC equipment

TEXAS VETERINARY MEDICAL DIAGNOSTIC LABORATORY

1. Facilities - 2400 sq. feet laboratory space with 3 fume hoods (1 explosion proof, 1 perchloric acid), 3 animal isolation rooms shared with other departments), mouse colony.

2. Equipment - Hewlett Packard 5992B GC/MS, superfloppy data system
Technicon SMA 12/60 serum auto analyzer
Waters ALC/GPC 204 HPLC, Model 440 detector, Model 660 solvent programmer
Varian Model 6 atomic absorption unit
Orion Model 801 ion analyzer/pH meter
Varian Model 634 UV/visible spectrophotometer
LKB Model 2103 electrophoresis power supply with Corning Model 740 densitometer
Precision Model 254 heating/cooling circulating system
Lindberg SB ashing furnace
Beckman Model J-21 ultracentrifuge
Varian Series 1700 GC
Buchler fraction collecter

USDA--LOGAN

The main office and laboratory building of the Poisonous Plant Research Laboratory contains approximately 5600 sq. feet of space with office and laboratory space for seven scientists and 2-3 graduate students or visiting scientists. In addition, there is one greenhouse with office and laboratory space for one scientist and one office and laboratory for one scientist on the Utah State University campus.

There are four chemistry rooms plus storage space in the chemistry area with equipment such as: mass spectrometer, NMR spectrometer, IR spectrophotometer, visible spectrophotometer, large scale plant extraction equipment, GC unit, GC/MS interface unit, Autopol (auto polarimeter), distillation unit, freeze drying unit, and electrophoresis apparatus. There is also a specially designed building for large scale plant extraction associated with the chemistry section.

The histopathology lab is a completely equipped laboratory with equipment and accessories available to do any type of histopathologic preparative procedure that may be needed. The histopathology complex consists of: 1) a large preparative laboratory; 2) a microscope room; and 3) a storage area. Preparative equipment and procedures are standard: tissue dehydration, clearing, and infiltration is accomplished by a Fisher Tissuematon (a precision vacuum oven is also available for infiltration of difficult tissues). The "Tissue-Tek" thermoelectric center is used for tissue blocking and a standard AO Spencer microtome for sectioning. An AO cryo-cut is used for frozen sections. Hematoxylin and eosin staining is routinely done but chemicals and accessories (incubator, refrigerator, fume hood, etc.) are available for special stains. Microtome blades are sharpened on a Spencer blade sharpener.

The microscope room houses a Zeiss photomicroscope with viewing screen; a standard Zeiss binocular microscope equipped with phase contrast, camera attachments, and accessories to do fluorescent antibody procedures; and a Zeiss stereo microscope.

The clinical chemistry lab (3 laboratory rooms) is equipped to do standard blood chemistry (blood sugar, protein, etc.) and a variety of serum enzymatic procedures as well as complete blood counts and smears, electrophoresis of several types, electrolytes, minerals, and blood gases. A Gilford spectrophotometer with a rapid sampler, digital absorbance meter, and recording densitometer is used for most procedures. Blood cell counts are done on a Coulter electronic counter; enzymatic procedures with the aid of 2 Dubnoff metabolic incubators; electrophoresis (acrilamyde starch gel, continuous flow) with the aid of standard power supplies and a high voltage power supply plus cells for disc, plate, and 2-dimensional electrophoresis; blood gases on a Corning pH blood gas instrument; electrolytes and minerals on a Perkin Elemer atomic absorption unit equipped with elements to measure most of the more important metals. Preparative equipment includes a standard centrifuge, a Sorvall high speed refrigerated centrifuge, a freeze dryer capable of handling multiple samples or bulk material in trays, and the usual ovens, hoods, refrigerators, deep freezes, micro and standard balances and several rotoevaporative units. A large capacity low temperature deep freeze (to minus 80°C) is available for holding blood and other samples until convenient to make enzymatic and other tests. There is a six unit Kjeldahl, ovens, hoods, and associated equipment for metabolism studies in a laboratory building for the individual feeding and handling of sheep.

Facilities for the study of pathophysiology in livestock due to plant toxicosis include: 1) a surgical area and attendant equipment for induction

and maintenance of general surgical anesthesia of small and large domestic livestock, as well as laboratory animals; 2) surgical instruments and materials sufficient to perform a variety of cardiovascular, thoracic, abdominal, and neurosurgical procedures; 3) biomedical electronic instrumentation for monitoring a wide spectrum of physiologic functions such as blood pressures, blood flow, cardiac output, body temperatures, respiratory rate and differential pressures, as well as electrophysiologic functions including electroencephalograms, electrocardiograms, and nerve conduction patterns. Real-time oscillographic records of 14 channels of physiologic function can be recorded with capability of magnetic tape recording of 7 channels of data; and 4) an instrumentation room housing physiological monitoring equipment has direct visual access and cable connection to animal rooms with contiguous holding pens for use in recording pathophysiological responses during plant poisoning experiments. Direct visual access to a large outside pen can be used for free roaming animals and recording of physiological data by radiotelemetry when deemed appropriate.

Facilities for physiology studies with poisonous plants includes a 3 bay greenhouse with adjoining headhouse and office. The greenhouse is equipped with equipment necessary for propagation of plants in soil or nutrient cultures. The laboratories are supplied with equipment such as dryers, centrifuges, chromatography equipment, hoods, and evaporators for the physiological and biochemical study of poisonous range weeds. There is also equipment for the application of herbicides to poisonous range plants. The Intermountain Herbarium is near to the Poisonous Plant Research Laboratory and their personnel assist in the identification and verification of plant material collected by personnel at the USDA Poisonous Plant Research Laboratory or material that is received for identification.

Inside shed space is used to handle as many as 50 cattle with surrounding corral space to handle an additional 125 animals. Cattle equipment includes portable corral panels, scales, squeeze chutes for field use as well as stationary scales and squeeze chutes. Facilities are available for the individual handling of animals for feeding, pregnancy testing, treatment, etc. Physiological monitoring equipment is housed in three rooms with individual crates to hold animals while being monitored. Facilities are available for surgery, postmortem, and treatment. Inside shed space is available for as many as 64 sheep, with surrounding corral space for an additional 300 sheep. Sheep equipment includes portable sheep scales, individual crates, and a temperature controlled metabolism building with 24 individual pens and 12 metabolism crates. Individual pens are available for lambing, and pens are available for sorting, feeding, breeding, and handling sheep. Inside shed space is available for as many as 24 pigs. Equipment for handling pigs includes portable scales, two farrowing crates, and chutes. Two high fenced outside corrals can be used to handle animals such as deer and elk and these facilities are also suitable for horses and goats. Inside temperature controlled rooms and pens are available for use with 48 rabbits and as many as 2,000 of a combination of hamsters, mice, rats, and guinea pigs.

A 6 bay building serves as a shop, equipment storage, and plant drying facility; 2 buildings serve to store equipment, supplies, and ground plants. One of these buildings has a walk-in cooler for plant storage. Covered hay and straw storage is available for approximately 400 tons. There are two metal graneries for storage of grain and alfalfa pellets. Equipment available to care for animals and plant material includes: tractors with scrapers and loaders, manure spreaders, tractor powered hammer mills, tractor powered grinder, mixer, bagger, small plant grinders that are under a hood for fume and

[illegible] serves as a [illegible]

[illegible] serve to store [illegible]

[illegible] of grain and [illegible]

dust protection, scale under a hood to weigh plant material, pelleting machine, automobile, 5 trucks, and a 16' cattle trailer plus other livestock moving equipment.

TAES - SAN ANGELO

1. Land Resources - The Texas A&M University Agricultural Research and Extension Center at San Angelo is ideally situated for field research on control and management of toxic rangeland plants. Land resources available for field research include:

   San Angelo - 50 acres owned by T.A.E.S. and 1,564 acres leased from the U.S. Army Corps of Engineers for 25 years (leased in 1972).

   H.D. Winters Ranch - 8,414 acres 80 miles east of San Angelo in McCulloch County leased in 1975 for a 10-year period, with 5-year renewal option.

   Francis Hill Ranch - 3,623 acres 100 miles south of San Angelo in Edwards County leased in 1977 for a 5-year period.

   Texas Range Station, Barnhart - Most field research on poisonous plants is conducted on privately owned land, on the Texas Range Station at Barnhart (3,161 acres) which is owned by the University of Texas but administered by Dr. Leo B. Merrill (T.A.E.S. - Sonora), or on other land owned and administered by the University of Texas.

2. Facilities - At the Research Center at San Angelo the Project Leaders have 120 sq. ft. offices and a second 120 sq. ft. office is shared by two Research Associates. Laboratory space at the San Angelo Research Center is fully utilized by other scientists. The laboratory has 2,000 sq. ft. and is adequately equipped with island benches and two six foot fume hoods (one hood is all stainless steel construction with a manual washdown feature). A 256 sq. ft. greenhouse has been constructed for use by this project. We also have a well equipped shop for maintenance of vehicles and

construction/repair of equipment, as well as storage areas for supplies, herbicides, etc. Major items of equipment available for research on control and management of toxic plants include:

Excellent laboratory and animal facilities exist at the Texas Agricultural Experiment Station's Research Center at San Angelo for conducting both laboratory and field studies on poisonous plants.

Animal facilities at the research center were designed for use with small ruminants (sheep and goats) but would work well with young cattle and could be modified for use with larger cattle. These facilities are adequate to support a wide variety of types of designed studies. Twenty metabolism stalls (designed for complete and separate collection of urine and feces) are housed in a feed evaluation building which also contains 24 stalls with stanchions for restraint of individual animals for detailed observations on feeding behavior or for infusion studies. This building has forced ventilation in summer, is heated during winter and is cleaned flushing with water. There is an additional covered area which contains 22 raised pens (4' x 6' with expanded metal floors) capable of housing 1 to 3 animals per pen, and 36- 8' x 24' pens along a covered concrete feed alley which will handle up to 10 sheep or goats per pen.

3. Equipment - Sherer environmental chamber
Puffer-Hubbard environmental chamber
VWR forced draft drying ovens (2)
3-point thermograph
Leeds & Northrup Speedomax multipoint recorder
General Electric mobile radio and two walkie-talkies
Slip-on-fire-fighting pumper
1979 Chevrolet crewcab pickup
16-foot gooseneck equipment trailer
40-horsepower farm tractor (John Deere 2040)
Integral disc plow (8-ft.)
Shop-made, 20-ft. boom-type sprayer
Autonomic Equipment Co. mist blower
And other minor equipment, such as hand tools, tapes, quadrats, clippers, scales, bucket augers, etc.
Bausch and Lomb Spectrophotometer (Spectronic 710),

Perkin-Elmer Atomic Absorption Spectrophotometer Model 290 equipped with a nitrous oxide burner,
Barber-Colman Gas Chromatograph with dual column temperature programming,
Beckman Model J-21 refrigerated, high speed centrifuge,
Beckman Model TJ-6 refrigerated centrifuge,
IEC Model K centrifuge,
Fiske Osmometer,
Labconco Freeze Dryer,
Mettler H35AR Analytical Balance,
Lidberg Heavy Duty Muffle Furnace,
Vacuum Ovens,
Brinkmann Rotavapor-R,
And other minor equipment, such as, shakers, force-draft ovens, constant temperature water baths, balances, pH Meters, etc.

PROFESSIONAL STAFF VITA

EVERETT MURL BAILEY, JR.

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Educational Background: D.V.M., Veterinary Medicine, Texas A&M University, 1964; M.S., Physiology, Iowa State University, 1966; Ph.D., Physiology, Iowa State University, 1968.

Work experience.

Jan. 81-Jun. 81 Visiting Professor, Food & Drug Administration, Rockville, Maryland
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1974-1981 Associate Professor, Veterinary Physiology and Pharmacology, Texas A&M University, College Station, TX
1970-1974 Assistant Professor, Veterinary Physiology and Pharmacology, Texas A&M Univeristy, College Station, TX

Area of research specilization. Toxicology, Anesthesiology, Pharmacology, Experimental Surgery and Clinical Medicine.

Relevant publications (1975-present).

Bailey, E.M. and Picken, J.C., Jr. 1969. Response of Normal Calves to Several Cancer Chemotherapeutic Agents. Am. J. Vet. Res. 30:1599-1606.
Bailey, E.M. and Picken, J.C., Jr. 1971. Effects of Two Alkylating Agents in Calves. Am. J. Vet. Res. 32:1715-1722.
Stewart, R.E. and Bailey, E.M. 1973. Hypothalamic Temperature Regulation in Cattle. Transactions of the American Society of Agricultural Engineers. 16:No.2, 334-339.
Rosborough, J.P., Bailey, E.M., Tacker, W.A. and Geddes, L.A. 1974. Experimental Anesthetization of a Dromedary Camel, Zentralblatt fur Veterinarmedizin. 21:149-156.
Szabuniewicz, M. and Bailey, E.M. 1975. A New Approach to the Treatment of Ethylene Glycol Poisonings in Dogs. Southwestern Veterinarian. 28: No.1, 7-11.
Bailey, E.M. and Szabuniewicz, M. 1975. Glyceryl Guaiacolate in the Treatment of Strychnine Poisoning in the Dog. VM/SAC. 170-174.
Stewart, R.E. and Bailey, E.M. 1975. Rapid THI Change and Hypothalamic-Rectal Temperatures of Heifers. Transactions of American Society of Agricultural Engineers, Paper No. 74-4505.
Szabuniewicz, M., Bailey, E.M. and Wiersig, D.O. 1975. A New Regimen for the Treatment of Ethylene Glycol Poisoning. IRCS Medical Science: Pharmacology. Veterinary Science. 3:102.

Bailey, E.M. 1975. Emergency Procedures in Intoxications, Veterinary Clinics of North America.

Bailey, E.M. 1978. Physiologic Responses of Livestock to Toxic Plants. Journal of Range Management. 31:343-347.

Hicks, T.W. and Bailey, E.M. 1978. Succinylcholine chloride as a Euthanitizing Agent in Dogs. Amer. J. Vet. Res. 39:1195.

Bailey, E.M. 1978. Management and Treatment of Toxicoses in Cattle. Proceedings of Annual Meeting of American Association of Bovine Practitioners, Baltimore, MD.

Menzies, J.S., Bridges, C.H. and Bailey, E.M. 1979. A Neurological Disease of Cattle Associated with Solanum dimidiatum. Southwestern Veterinarian. 32:(1).

Miller, C.S. and Bailey, E.M. 1979. Arsenic Acid Use and Hazard Assessment in the Desiccation of Cotton. Miscellaneous Publication MP-1434. Texas Agricultural Experiment Station. 5 pages.

Bridges, G.W. and Bailey, E.M. 1980. Prevention of Bitterweed (Hymenoxys odorata) Intoxication of Sheep. Veterinary and Human Toxicology. 22:No.2, 87-90.

Muchiri, D.J. and Bailey, E.M. 1980. Kleingrass Photosensitization in Sheep. Journal of American Veterinary Medical Association. 177:No.3.

Hill, D.W., Bailey, E.M. and Camp, B.J. 1980. Tissue Distribution and Disposition of Hymenoxon. Agric. and Food Chem. 28:1269-1273.

Terry, M.K., Kim, H.L., Corrier, D.E. and Bailey, E.M. 1980. The Acute Oral Toxicity of Hymenoxon in Sheep. Res. Comm. Chem. Path. and Pharm. 31:No.1, 181-184.

Beerwinkle, K., Stewart, R.E. and Bailey, E.M. 1980. Disposition of Polydispersed Aerosols in Cattle. Transactions of the American Society of Agricultural Engineers.

Stewart, R.E. and Bailey, E.M., Jr. 1981. Thermo Regulation in Calves Subjected to Rapid Environmental Heat Input. Technical Monograph #10. Texas Agricultural Experiment Station. October.

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Work Experience.

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1963-1968 Instructor, Agricultural Engineering Department, Texas A&M University, College Station, TX
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Area of research specialization. Development and application of instrumentation and measurement systems for obtaining data in cooperative research projects dealing with large animal toxicology and livestock-related insects.

Relevant publications (1975-present).

Beerwinkle, K. R. and I. L. Berry. 1975. Solid-state light-intensity controller for biological research. USDA, ARS-S-77. 5 pp.
Witzel, D. A., E. L. Smith, K. R. Beerwinkle and J. H. Johnson. 1976. Arsanilic acid-induced blindness in swine: Electroretinographic and visually evoked responses. Am. J. Vet. Res. 37(5):521-524.
Beerwinkle, K. R. and J. J. Burch. 1976. A low-power combination electrocardiogram-respiration telemetry transmitter. Inst. Elect. Electron. Eng. Trans. Biomed. Eng. 23(6):484-486.
Beerwinkle, K. R. and D. A. Witzel. 1976. A pneumatically-driven, electronically-controlled respirator for use with large animal inhalation anaesthesia systems. Vet. Anaesthesia 3(2):110-115.
Verlander, J. M., K. R. Beerwinkle and W. P. Fife. 1978. Radiotelemetry system for obtaining body temperature during simulated diving to 1000 FSW. Aviat. Space Environ. Med. 49(4):641-643.
Beerwinkle, K. R., I. L. Berry and Kunz, S. E. 1978. Prediction models for mortality of immature stable flies caused by cold temperatures. Environ. Entomol. 7(2):273-277.
Beerwinkle, K. R. 1978. Telemetry transmitter with continual calibration for precise measurement of body temperatures of large animals. Trans. ASAE. 21(2):349-352.

and J. [illegible] 197[illegible]
[illegible] biological research. ISLA, [illegible]
[illegible] L. Smith, [illegible] K. [illegible] [illegible]
[illegible] induced blindness [illegible]
[illegible] responses. Am. J. Vet. Res. [illegible]
R. [illegible] J. Burch. 1976. A low-power
[illegible] respiration telemetry
[illegible] Trans. Biomed Eng. 23(3):181-[illegible]
and D. A. Witzel. 1976. A pneumatically [illegible]
[illegible] controlled respirator for use with large [illegible]
[illegible] Vet. Anaesthesia 3(2):110-115
[illegible] R. Beerwinkle and W. R. Fite. 1978. Radio[illegible]
[illegible] body temperature during simulated [illegible]
[illegible] Med. 49(4):641-643.
[illegible] Berry and Kunz, [illegible] E. 1978. Predictive models for
[illegible] flies caused by cold temperatures. [illegible]
[illegible] calibration for
[illegible] animals. Trans. [illegible]

Beerwinkle, K. R. 1979. A low-power, multichannel transmitter for biotelemetry. Trans. ASAE. 22(4):847-849.

Beerwinkle, K. R. 1979. Deposition patterns of inhaled polydisperse aerosols in weanling calves. Texas A&M Univ. 133 pp. (Dissertation)

DeVaney, J. A. and K. R. Beerwinkle. 1980. A non-chemical method of controlling the northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago), on caged White Leghorn hens. Poult. Sci. 59(6):1226-1228.

DeVaney, J. A. and K. R. Beerwinkle. 1980. Effects of microwave and various combinations of ambient temperature and humidity exposures on off-host survival of northern fowl mites. Poult. Sci. 59(10):2198-2201.

Beerwinkle, K. R. and G. T. Fincher. 1980. Automatic trap for determining hourly flight activity of dung beetles. Southwest. Entomol. 5(2):107-111.

Beerwinkle, K. R. and P. A. March. 1981. A cam-operated, electronic proportional-control system for laboratory simulation of outside summer temperatures. Southwest. Entomol. 6(1):53-56.

Beerwinkle, K. R. and J. A. DeVaney. 1981. Instrumentation for measuring activity of mites and similar crawling insects, *in vitro*. Southwest. Entomol. 6(1):65-69.

Beerwinkle, K. R. and J. A. DeVaney. 1981. Relative activity responses of the northern fowl mite to five gaseous environments, *in vitro*. Southwest. Entomol. 6(1):70-74.

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1965-1969 (Summers) Entomologist, Oconomowoc Canning Co., Sun Prairie, WI

Area of research specilization. Bio/Organic chemistry.

Relevant publications (1975-present).

Beier, R. 1978. Stereochemical assignment at the C-13 carbon on pimaradienes by carbon-13 NMR. A Reassessment. Org. Magn. Reson. 11:586.
Beier, R. and B. P. Mundy. 1979. A facile removal of the tetrahydropyranyl protecting group from alcohol derivatives. Synth. Comm. 9:271-273.
Beltran, J. P., G. A. Strobel, R. Beier and B. P. Mundy. 1980. Some synthetic phytotoxins structurally related to rhynchosporoside. Plant Physiol. 65:554-556.
Beier, R. C. 1980. Carbohydrate chemistry. Synthetic and structural investigation of the phytotoxins found in *Helminthosporium saccari*, and *Rhynochosporium secalis*. (Thesis)
Beier, R. C., B. P. Mundy and G. A. Strobel. 1980. Assignment of anomeric configuration and identification of carbohydrate residues by ^{13}C-NMR: I. Galacto- and gluco-pyranosides and furanosides. Can. J. Chem. 58:2800-2804.
Beier, R. C., B. P. Mundy and G. A. Strobel. 1981. Synthesis of diastereomeric isofloridoside. Carbohyd. Res. 93:141-143.

Stipanovic, R. D., G. A. Greenblatt, R. C. Beier and A. A. Bell. 1981. 2-Hydroxy-7-methoxycadalene. The precursor of lacinilene C 7-methyl ether in *Gossypium*. Phytochemistry 20:729-730.

Beier, R. C. and G. A. Greenblatt. 1981. A novel solvent strategy for SEP-PAK C_{18} elution of hydrophobic compounds: Applications to lacinilenes and cadalenes from cotton bract. J. Liq. Chrom. 4:515-524.

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Work experience.

1971-present Associate Professor, Agricultural Research and Extension Center, Texas A&M University, San Angelo, Texas
1972-present Sheep and goat nutrition research, Texas Agricultural Experiment Station, San Angelo, Texas
1968-1971 Assistant Professor, Agricultural Experiment Station, Texas A&M University, San Angelo, Texas
1968-1972 Sheep and goat nutrition research, Texas Agricultural Experiment Station, McGregor, Texas
1974-1975, 1978-present Adjunct Professor, Agricultural Department, Angelo State University
1972- U.S.-A.I.D. short-term consultant in ruminant nutrition and physiology, Argentina
1967-1968 Assistant Professor, Animal Science and Agricultural Biochemistry Department, University of Delaware
1961-1966 Research Assistant, Nutrition Section, Animal Science Department, University of Connecticut
1958-1961 Research Assistant, Nutrition Section, Animal and Poultry Science Department, University of Delaware

Area of Research Specialization. Ruminant Nutrition

Relevant publications (1975-present).

Calhoun, M.C., Baldwin, B.C. and Livingston, C.W. 1978. Reduction in Blood Thiols in Subacute Bitterweed Toxicity. T.A.E.S. Prog. Rpt. 3512.
Calhoun, M.C., Uecker, D.N., Livingston, C.W. and Camp, B.J. 1978. Effect of Spray with 2,4-D on Hymenoxon Concentration and Toxicity of Harvested Bitterweed Fed to Sheep. T.A.E.S. Prog. Rpt. 3511.
Calhoun, M.C., Ueckert, D.N., Livingston, C.W. and Baldwin, B.C. 1978. Association Between Bitterweed Dose, Voluntary Feed Intake and Some Blood Serum Constituents of Sheep. T.A.E.S. Prog. Rpt. 3510.
Baldwin, B.C. and Calhoun, M.C. 1979. Dietary Protein and Subacute Bitterweed Poisoning in Sheep. T.A.E.S. Prog. Rpt. 3571.
Calhoun, M.C., Baldwin, B.C. and Livingston, C.W. 1979. Effect of Abomasal Cysteine Addition on Response to Subacute Bitterweed (Hymenoxys odorata) Poisoning. T.A.E.S. Prog. Rpt. 3570.

Calhoun, M.C., Ueckert, D.N., Merrill, L.B., Camp, B.J. and Baldwin, B.C. 1980. Effect of 2,4-D on Hymenoxon Levels and Toxicity of Bitterweed. Tex. Agr. Exp. Sta. Prog. Rpt. 3696.

Calhoun, M.C. and Baldwin, B.C. 1980. Sheep Tolerance to Bitterweed Poisoning--variation between animals. Tex. Agr. Exp. Sta. Prog. Rpt. 3695.

Baldwin, B.C. and Calhoun, M.C. 1981. The Effect of Natural Protein on Bitterweed Poisoning in Sheep. Tex. Agr. Exp. Sta. Prog. Rpt. (In Press).

Calhoun, M.C., Baldwin, B.C. and Pfeiffer, F.A. 1981. Bitterweed Adaptation in Sheep. Tex. Agr. Exp. Sta. Prog. Rpt. (In Press).

Calhoun, M.C., Ueckert, D.N., Livingston, C.W. and Camp, B.J. 1981. Effect of 2,4-D on Hymenoxon Concentration and Toxicity of Bitterweed (*Hymenoxys odorata*) Force-Fed to Sheep. J. Range Manage. (Submitted).

Calhoun, M.C., Ueckert, D.N., Livingston, C.W. and Baldwin, B.C. 1981. Effects of Bitterweed (*Hymenoxys odorata*) on Voluntary Feed Intake and Serum Constituents of Sheep. Am. J. Vet. Res. 42:49.

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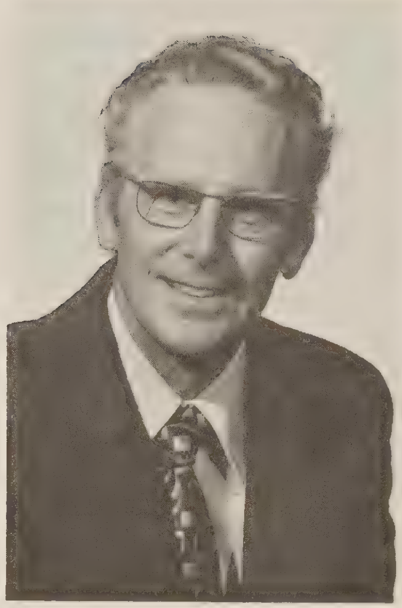

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Work experience.

1969-present Professor, Veterinary Physiology and Pharmacology, Texas A&M University, College Station, TX
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1951-1956 Graduate Assistant, Biochemistry and Biophysics, Texas A&M University, College Station, TX
1949-1951 Teacher, Sulphur Springs Independent School District

Area of research specialization. Pollution, Toxicology and Natural Products.

Relevant publications (1975-present).

Conkle, J.P., Camp, B.J., Welch, B.E. 1975. Trace Composition of Human Respiratory Gas. Archives of Environmental Health. 30:290-295.
Kim, H.L., Rowe, L.D. and Camp, B.J. 1975. Hymenoxon, A Poisonous Sesquiterpene Lactone from Hymenoxys Odorata DC. (Bitterweed). Res. Comm. Chem. Path. Pharmacol. 11:647.
Smith, B.P., Hejtmancik, E. and Camp, B.J. 1976. Acute Effects of Cadmium on Ictalurus Punctatus (Catfish). Bull. Environ. Contam. Toxicol. 15:271.
Gilmartin, W.G., Camp, B.J. and Lewis, D.H. 1976. Bath Treatment of Channel Catfish with Three Broad-Spectrum Antibiotics. Journal of Wildlife Diseases. 12:555.
Hill, D.W., Hejtmancik, E. and Camp, B.J. 1976. Induction of Hepatic Microsomal Enzymes by Aroclor ^{R} 1254 in Ictalurus Punctatus (Channel Catfish). Bull. Environmental Contamination and Toxicology. 16:495.
Hill, D.W., Kim, H.L., Martin, C.L. and Camp, B.J. 1977. Identification of Hymenoxon in Baileya Multiradiata and Helenium Hoopsii. J. Agric. Food Chemistry. 25:1304.
Aliu, Y.O., Davis, R.H., Camp, B.J. and Kuttler, K.L. 1977. Absorption, Distribution, and Excretion of Imidocarb Dipropionate in Sheep. AJVR. 38:2001.

Halder, Clive A., Taber, Ruth A. and Camp, Bennie J. 1979. High Performance Liquid Chromatography of the Mycotoxin, Sporidesmin, from Pithomyces chartarum. J. Chromatography. 175:356-361.

Hill, Dennis W. and Camp, Bennie J. 1979. Reactions of Hymenoxon: Base Conversion to Psilotropin and Greenin and Formation of "Michael Adduct" with Cysteine. J. Agric. Food Chemistry. 27:882-885.

Hill, Dennis W., Kim, H.L. and Camp, Bennie J. 1979. Quantitative Analysis of Hymenoxon in Plant Tissue. J. Agric. Food Chemistry. 27:885-887.

Williams, G.D., Rippon, Paula, Chen, Ping-Mai and Camp, Bennie J. 1979. An Improved Gas-Liquid Chromatographic Procedure for the Determination of 3-Methylindole in Rumen Liquor, Plasma and Tissue of Ruminants. Analytical Biochemistry. 99:324-331.

Wolf, Harold W., Camp, Bennie J., Hawkins, Scott J. and Jorgensen, James H. Pyrogenic Activity of Carbon-Filtered Waters. Environmental Protection Agency. EPA-600:1-79-009.

Rouquette, F.M., Jr., Keisling, T.C., Camp, B.J. and Smith, K.L. 1980. Characteristics of the Occurrence and Some Factors Associated with Reduced Palatability of Pearl Millet. Agronomy Journal. 72:173-174.

Hill, D.W., Bailey, E.M. and Camp, B.J. 1980. Tissue Distribution and Disposition of Hymenoxon. J. Agric. Food Chemistry. 28:1269-1273.

Rowe, L.D., Kim, H.L. and Camp, B.J. 1980. The Antagonistic Effect of L-Cysteine in Experimental Hymenoxon Intoxication in Sheep. Amer. J. Vet. Res. 41:No.4, 484-486.

Bridges, G.W., Bailey, E.M. and Camp, B.J. 1980. Prevention of Bitterweed Intoxication of Sheep. Vet. and Human Tox. 22:No.2, 87-90.

Halder, Clive A., Hejtmancik, Estelle, Camp, B.J. and Bridges, Charles H. 1980. An Alternative Extraction Procedure for the Isolation of Sporidesmin from Pithomyces chartarum (Berk. & Curt.) M.B. Ellis. New Zealand Journal of Ag. Res. 23:399-402.

Halder, Clive A., Taber, Ruth A. and Camp, B.J. 1981. Absence of Sporidesmin Production by Twelve Isolates of Pithomyces spp. Applied and Envir. Microbiology. 41:No.1, 212-215.

Clark, Donald E., Ivie G. Wayne and Camp, Bennie J. 1981. Effects of Dietary Hexachlorobenzene (HCB) on In Vivo Biotransformation, Residue Deposition and Elimination of Certain Xenobiotics By Rats. J. Agric. Food Chemistry. 600-608.

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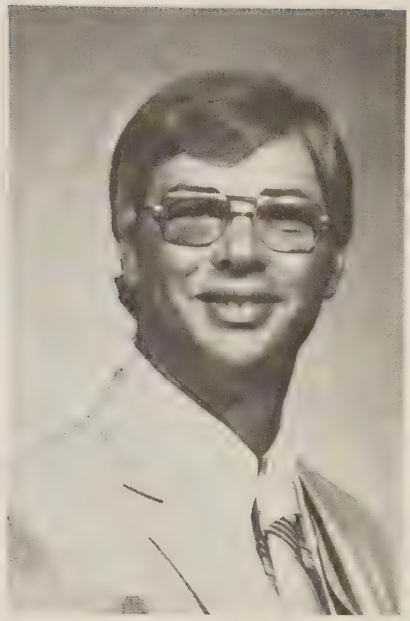

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Work experience.

1970-present Research Chemist, Veterinary Toxicology and Entomology Research Laboratory, ARS, USDA, College Station, TX
1961-1970 Research Chemist, Toxicological Investigations Laboratory (TIL), ARS, USDA, Kerrville, TX

Area of research specialization. Toxicology/Biochemistry.

Relevant publications (1975-present).

Clark, D. E., J. S. Palmer, R. D. Radeleff, H. R. Crookshank and F. M. Farr. 1975. Residues of chlorophenoxyacid herbicides and their phenolic metabolites in tissues of sheep and cattle. J. Agric. Food Chem. 23(3):573-578.
Mollenhauer, H. H., J. H. Johnson, R. L. Younger and D. E. Clark. 1975. Ultrastructural changes in liver of the rat fed hexachlorobenzene. Am. J. Vet. Res. 36(12):1777-1781.
Mollenhauer, H. H., J. H. Johnson, R. L. Younger and D. E. Clark. 1976. A unique intracellular aberration related to hexachlorobenzene ingestion. Am. J. Vet. Res. 37(7):847-850.
Clark, D. E. 1976. The effect of hexachlorobenzene on *in vivo* biotransformation, residue deposition and elimination of certain exogenous compounds and on body weight and organ weight in the rat. Texas A&M Univ. 125 pp. (Dissertation)
Johnson, J. H., M. H. Elissalde and D. E. Clark. 1977. A technique for sampling subcutaneous fat from the tailhead of sheep. Am. J. Vet. Res. 38(10):1635-1636. 1977.
Mollenhauer, H. H., M. H. Elissalde, D. E. Clark, E. G. Steel and J. J. Doyle. 1979. Combinative effects of hexachlorobenzene and crowding on rat adrenal cell mitochondria. Vet. Hum. Toxicol. 21(4):258-261.

Doyle, J. J., Clark, D. E. and Norman, J. O. 1979. Effects of dietary hexachlorobenzene on distribution of some trace metals in rat tissues. Bull. Environ. Contam. Toxicol. 21:225-229.

Clark, D. E., Ivie, G. W., Crookshank, H. R., DeVaney, J. A., and Bull, D. L. 1979. Effects of sulprofos and its sulfoxide and sulfone metabolites on laying hens fed the compounds in the diet. J. Agric. Food Chem. 27(1):103-107.

Elissalde, M. H. and Clark, D. E. 1979. Testosterone metabolism by hexachlorobenzene-induced hepatic microsomal enzymes. Am. J. Vet. Res. 40(12):1762-1766.

Ziprin, R. L., Elissalde, M. H., Clark, D. E. and Wilson, R. D. 1980. Absorption of polychlorinated biphenyl by the ovine lymphatic system. Vet. Hum. Toxicol. 22(5):305-308.

Clark, D. E., Ivie, G. W. and Camp, B. J. 1981. Effects of dietary hexachlorobenzene on in vivo biotransformation, residue deposition, and elimination of certain xenobiotics by rats. J. Agric. Food Chem. 29(3):600-608.

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Educational background. B.S., Utah State Agricultural College, 1951; M.S., University of Wyoming, 1951; Ph.D., Utah State University, 1962.

Work experience.

1952-present Poisonous Plant Research Laboratory, ARS, USDA, Logan, UT

Area of research specialization. Ecology and control of poisonous range plants.

Relevant publications (1975-present).

Cronin, E. H. 1976. The impact of controlling tall larkspur on the associated vegetation. J. Range Management 29(3):202-206.
Cronin, E. H., D. B. Nielsen and N. Madsen. 1976. Cattle losses, tall larkspur, and their control. J. Range Management 29(5):364-367.
Keeler, R. F., E. H. Cronin and J. L. Shupe. 1976. Lupin alkaloids from teratogenic and nonteratogenic lupins. IV. Concentration of total alkaloids, individual major alkaloids, and the teratogen anagyrine as a function of plant parts and stage of growth and their relationship to crooked calf disease. J. Tox. Environ. Health 1:899-908.
Nielsen, D. B. and E. H. Cronin. 1977. Economics of tall larkspur control. J. Range Management 39(6):434-438.
Cronin, E. H. and D. B. Nielsen. 1978. Tall Larkspur and Cattle on High Mountain Ranges, pp. 521-534. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.
Cronin, E. H., P. Ogden, J. A. Young and W. Laycock. 1978. The ecological niches of poisonous plants in range communities. J. Range Management 31(5):328-334.
Cronin, E. H. and D. B. Nielsen. 1979. The ecology and control of rangeland larkspurs. Utah Agric. Exp. Sta. Bull. No. 499. 34 pp.
Cronin, E. H. and D. B. Nielsen. 1980. Larkspurs - A deadly beauty. Utah Science 41(1):7-11.
James, L. F., R. F. Keeler, A. E. Johnson, M. C. Williams, E. H. Cronin and J. D. Olsen. 1980. Plants poisonous to livestock in the western states. USDA, Agric. Inform. Bull. No. 415. 90 pp.

[illegible] Range Management [illegible] (3) [illegible]

[illegible] Nielsen and M. [illegible] and their control [illegible] J. Range Manage [illegible]

[illegible] Cronin and [illegible] 1976. [illegible] nonteratogenic lupines. IV. [illegible] individual major alk[illegible], and [illegible] of [illegible] parts and [illegible]

[illegible] J. [illegible] Environ. [illegible]

[illegible] and [illegible] H. Cron[illegible] 1977. Economics [illegible] Management 30(6):434-438.

[illegible] and D. [illegible] Nielsen. 1978. Tall Larkspur and [illegible] pp. 21-534. In R. F. Keel[illegible], K. R. [illegible] Effects of Poisonous Plants on Livestock. [illegible]

Ogden, [illegible] Young and W. Laycock. 1978. [illegible] ecological [illegible] sonous [illegible] in range communities. J. Range [illegible]

[illegible] 1974. The ecology and contr[illegible] Agric. Exp. [illegible] Bull. No. 499. 14 pp.

[illegible] Nielsen. 19[illegible]. Larkspurs - A de[illegible]ly beauty [illegible]

[illegible] Johnson, M. C. Williams, L. H. Cronin and J. [illegible] to livestock in the western states. [illegible]

Cronin, E. H., M. C. Williams and J. D. Olsen. 1981. Toxicity and control of kelsey milkvetch. J. Range Management 35(5):181-183.
iewicz, P. F. and Cronin, E. H. 1981. Germination of seed of three varieties of spotted locoweed. J. Range Management 34(2):94-97.
Williams, M. C. and Cronin, E. H. 1981. Ten-year control of western false hellebore. Weed Sci. 29:22-23.
Cronin, E. H. 1981. Contributed to: Bovey, R. W. Responses of selected woody plants in the United States to herbicides. USDA, ARS. Agric. Handbook No. 493.

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Educational background. B.S., Biology, Eastern New Mexico State University, 1966; M.S., Entomology, University of Arkansas, 1967; Ph.D., Entomology, Texas A&M University, 1976.

Work experience.

1972-present Research Entomologist, USDA, ARS, College Station, TX
1967-1972 Research Entomologist, ARS, USDA, Mission, Tx

Area of research specialization. Medical and veterinary entomology--Poultry ectoparasites.

Relevant publications (1975-present).

Eddy, G. W., J. A. DeVaney, B. D. Handke and E. Lopez. 1975. Attractants for screwworm: Irradiation effects on bacteria-inoculated media. Ann. Entomol. Soc. Am. 68(2):269-270.

Eddy, G. W., J. A. DeVaney and B. D. Handke. 1975. Response of the adult screwworm (Diptera:Calliphoridae) to bacteria-inoculated and incubate bovine flood in olfactometer and oviposition tests. J. Med. Entomol. 12(3):379-381.

DeVaney, J. A. and J. J. Garcia. 1975. Longevity, oviposition, and fertility of several strains of the screwworm, Cochliemyia hominivorax (Diptera: Calliphoridae). J. Med. Entomol. 12(5):511-513.

DeVaney, J. A. 1976. Effects of the chicken body louse, Menacanthus stramineus, on caged layers. Poult. Sci. 55:430-435.

Meola, S. M. and J. A. DeVaney. 1976. Parasitism of mallophaga by Trenomyces histophtorus. J. Invertebr. Pathol. 28:151-157.

DeVaney, J. A. 1976. Effects of the northern fowl mite on White Leghorn roosters. Texas A&M Univ. 58 pp. (Dissertation)

DeVaney, J. A., M. H. Elissalde, E. G. Steel, B. F. Hogan and H. D. Petersen. 1977. Effect of the northern fowl mite, Ornithonyssus sylviarum (Canestrini and Fanzago) on White Leghorn roosters. Poult. Sci. 56:1585-1590.

DeVaney, J. A. 1978. Effect of the northern fowl mite, Ornithonyssus sylviarum (Canestrini and Fanzago), on fertility and hatchability of eggs from artificially inseminated White Leghorn hens. Poult. Sci. 57:1189-1191.

DeVaney, J. A. 1978. A survey of poultry ectoparasite problems and their research in the United States. Poult. Sci. 57:1217-1220.

Clark, D. E., G. W. Ivie, H. R. Crookshank, J. A. DeVaney and D. L. Bull. 1979. Effects of sulprofos and its sulfoxide and sulfone metabolites on laying hens fed the compounds in the diet. J. Agric. Food Chem. 27:103-107.

DeVaney, J. A. 1979. The effects of the northern fowl mite, *Ornithonyssus sylviarum* on egg production and body weight of caged White Leghorn hens. Poult. Sci. 58:191-194.

DeVaney, J. A. and R. L. Ziprin. 1980. Detection and correlation of immune responses in White Leghorn chickens to northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago) populations. Poult. Sci. 59:34-37.

DeVaney, J. A. and G. W. Ivie. 1980. Systemic activity of coumaphos, famphur, crufomate, ronnel and phosmet given orally to hens for control of the northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago). Poult. Sci. 59(6):1208-1210.

DeVaney, J. A. and K. R. Beerwinkle. 1980. A non-chemical method of controlling the northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago), on caged White Leghorn hens. Poult. Sci. 59(6):1226-1228

DeVaney, J. A. and K. R. Beerwinkle. 1980. Effects of microwave and various combinations of ambient temperature and humidity exposures on off-host survival of northern fowl mites. Poult. Sci. 59(10):2198-2201.

DeVaney, J. A. and R. L. Ziprin. 1980. Acquired immune response of White Leghorn hens to populations of northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago). Poult. Sci. 59(8):1742-1744.

DeVaney, J. A., J. H. Quisenberry, B. H. Doran and J. W. Bradley. 1980. Dispersal of the northern fowl mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago), and the chicken body louse, *Menacanthus stramineus* (Nitzsch), among 30 strains of egg-type hens in a caged laying house. Poult. Sci. 59(8):1745-1749.

Beerwinkle, K. R. and J. A. DeVaney. 1981. Instrumentation for measuring activity of northern fowl mites *in vitro*. Southwest. Entomol. 6(1):65-69.

Beerwinkle, K. R. and J. A. DeVaney. 1981. Relative activity responses of northern fowl mites to five gaseous environments, *in vitro*. Southwest. Entomol. 6(1):70-74.

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Educational background. B.S., Biology, Lamar University, 1963; M.S., Zoology, 1966; Ph.D., Zoology, Texas A&M University, 1971.

Work experience.

1974-present Research Physiologist (Animal), Veterinary Toxicology and Entomology Research Laboratory, ARS, USDA, College Station, TX
1971-1974 Assistant Professor of Biology, Southwest Texas State University, San Marcos, TX
1969-1971 Instructor of Biology, Southwest Texas State University, San Marcos, TX
1965-1969 Teaching Assistant, Texas A&M University, College Station, TX
1964-1965 Research Assistant, Texas A&M University, College Station, TX

Area of research specialization. Animal physiology.

Relevant publications (1975-present).

Elissalde, M. H. 1975. A Laboratory Manual and Study Guide for Anatomy and Physiology. 2nd Ed., Kendall/Hunt Publishing Co., Dubuque, IA. 147 pp.
DeVaney, J. A., M. H. Elissalde, E. G. Steel, B. F. Hogan and H. D. Petersen. 1977. Effect of the northern fowl mite, Ornithonyssus sylviarum (Canestrini and Fanzago), on white leghorn roosters. Poult. Sci. 56(5):1585-1590.
Johnson, J. H., M. H. Elissalde and D. E. Clark. 1977. Technique for sampling subcutaneous fat from the tailhead of sheep. Am. J. Vet. Res. 38(10):1635-1636.
Crookshank, H. R., M. H. Elissalde, R. G. White, D. C. Clanton and H. E. Smalley. 1979. Effects of transportation and handling of calves upon blood serum composition. J. Anim. Sci. 48(3):430-435.
Mollenhauer, H. H., M. H. Elissalde, D. E. Clark, E. G. Steel and J. J. Doyle. 1979. Combinative effects of hexachlorobenzene and crowding on rat adrenal cell mitochondria. Vet. Hum. Toxicol. 21(4):258-261.
Norman, J. O. and M. H. Elissalde. 1979. Abortion in laboratory animals induced by Moraxella bovis. Infect. Immun. 24(2):427-433.
Elissalde, M. H. and D. E. Clark. 1979. Testosterone metabolism by hexachlorobenzene-induced hepatic microsomal enzymes. Am. J. Vet. Res. 40(12):1762-1766. 1979.

Elissalde, M. H. and G. A. Greenblatt. 1979. The role of cyclic AMP and cyclic GMP in byssinosis. Am. Ind. Hyg. Assoc. J. 40(12):1067-1074.

Elissalde, M. H., G. A. Greenblatt and R. L. Ziprin. 1980. The role of prostaglandin F_2 in byssinosis. Am. Ind. Hyg. Assoc. J. 41(5):382-384.

Elissalde, G. S., J. B. Wooldridg, E. G. Steel and M. H. Elissalde. 1980. A case report: Treatment of a seizuring hypoparathyroid dog. Canine Practice 7(5):14-25.

Ziprin, R. L., E. G. Steel, H. D. Petersen, M. H. Elissalde and M. McCarter. 1980. Hematological study of the effects of levamisole on stressed cattle. Am. J. Vet. Res. 41(11):1884-1885.

Ziprin, R. L., M. H. Elissalde, D. E. Clark and R. D. Wilson. 1980. Absorption of polychlorinated biphenyl by the ovine lymphatic system. Vet. Hum. Toxicol. 22(5):305-308.

Fowler, S. R., R. L. Ziprin, M. H. Elissalde and G. A. Greenblatt. The etiology of byssinosis--Possible role of prostaglandin F_2 synthesis by aveolar macrophages. Am. Ind. Hyg. Assoc. J. 42(6):445-448.

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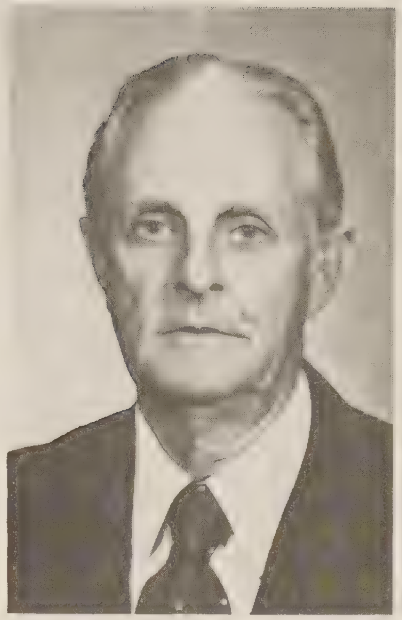

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Education background. B.S., Natural Science and Mathematics, Arkansas A&M, 1949.

Work experience.

1977-present Research Chemist, Veterinary Toxicology and Entomology Research Laboratory, ARS, USDA, College Station, TX
1955-1977 Research Chemist, U. S. Livestock Insects Laboratory, ARS, USDA, Kerrville, TX
1951-1955 DOD, Chemical Warfare, Pine Bluff Arsenal, Pine Bluff, AK

Area of research specialization. Pesticide residues.

Relevant publications (1975-present).

Ivey, M. C. and H. D. Mann. 1975. Gas-liquid chromatographic determination of ethion, ethion monooxon, and ethion dioxon in tissues of turkeys and cattle. J. Agric. Food Chem. 23(2):319-321.
Ivey, M. C., S. E. Kunz and H. D. Mann. 1975. Ethion, ethion monooxon, and ethion dioxon: Residues in the body tissues of turkeys confined in pens on treated soil. J. Econ. Entomol. 68(3):353-354.
Ivey, M. C., J. S. Palmer and R. H. Washburn. 1976. Famphur and its oxygen analogue: Residues in the body tissues of reindeer. J. Econ. Entomol. 69(2):260-262.
Ivey, M. C. and D. D. Oehler. 1976. Gas-liquid chromatographic determination of iodofenphos and several related compounds in tissues and urine of cattle. J. Agric. Food Chem. 24(5):1049-1053.
Ivey, M. C., H. D. Mann and F. C. Wright. 1976. Ronnel and itx oxygen analogue: Residues in the body tissues and eggs of caged layers. J. Econ. Entomol. 69(60:744-746.
Ivey, M. C., J. S. Palmer and E. C. Hooten. 1978. Chlorpyrifos and 3,5,6-trichloro-2-pyridinol: Residues in the body tissues of cattle wearing chlorpyrifos-impregnated plastic ear bands. J. Econ. Entomol. 71(4):697-700.
Ivey, M. C. 1979. Chlorpyrifos and 3,5,6-trichloro-2-pyridinol: Residues in the body tissues of cattle wearing chlorpyrifos-impregnated plastic ear tags. J. Econ. Entomol. 72(6):909-911.
Ivey, M. C. and J. S. Palmer. 1979. Chlorpyrifos and 3,5,6-trichloro-2-pyridinol: Residues in body tissues of swine treated with chloropyrifos for hog louse and itch mite control. J. Econ. Entomol. 72(6):837-838.

Ivey, M. C. and J. S. Palmer. 1981. Chlorpyrifos and 3,5,6-trichloro-2-pyridinol: Residues in the body tissues of sheep treated with chloropyrifos for sheep ked control. J. Econ. Entomol. 74(2):136-137.

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Work experience.

1977-present Research Chemist and Leader, Veterinary Toxicology and Entomology Research Laboratory, ARS, USDA, College Station, TX
1972-1977 Research Chemist, Veterinary Toxicology and Entomology Research Laboratory ARS, USDA, College Station, TX
1971-1972 Research Specialist, University of Kentucky, Lexington, KY
1971 Postgraduate Research Entomologist, University of California, Berkeley, CA

Area of research specialization. Metabolism and environmental chemistry of pesticides; chemistry of plant toxins.

Relevant publications (1975-present).

Ivie, G. W., D. A. Witzel, W. Herz, R. Kannan, J. O. Norman, D. D. Rushing, J. H. Johnson, L. D. Rowe and J. A. Veech. 1975. Hymenovin: Major toxic constituent of Western bitterweed (*Hymenoxys odorata* DC.). J. Agric. Food Chem. 23(5):841-845.
Ivie, G. W., D. A. Witzel and D. D. Rushing. 1975. Toxicity and milk bittering properties of tenulin, the major sesquiterpene lactone constituent of *Helenium amarum* (Bitter sneezeweed). J. Agric. Food Chem. 23(5):845-849.
Ivie, G. W. 1975. Metabolic fate of perfluidone herbicide in a lactating cow. J. Agric. Food Chem. 23(5)869-872.
Ivie, G. W., D. L. Bull and D. A. Witzel. 1976. Metabolic fate of *O*-Ethyl *O*-[4-(Methylthio)phenyl-^{14}C]*S*-propyl phosphorodithioate (BAY NTN 9306) in a lactating cow. J. Agric. Food Chem. 24(1):147-151.
Ivie, G. W. 1976. Epoxide to Olefin: A novel biotransformation in the rumen. Science 191:959-961.
Ivie, G. W., J. E. Wright and H. E. Smalley. 1976. Fate of the juvenile hormone mimic 1-(4-Ethylphenoxy)-3,7-dimethyl-6,7-epoxy-*trans*-2-octene (Stauffer R-20458) following oral and dermal exposure to steers. J. Agric. Food Chem. 24(2):222-227.

Ivie, G. W., D. A. Witzel, W. Herz, R. P. Sharma and A. E. Johnson. 1976. Isolation of hymenovin from Hymenoxys richardsonii (Pinque) and Dugaldia hoopesii (Orange sneezeweed). J. Agric. Food Chem. 24(3):681-682.

Witzel, D. A., G. W. Ivie and J. W. Dollahite. 1976. Mammalian toxicity of helenalin, the toxic principle of Helenium microcephalum DC (smallhead sneezeweed). Am. J. Vet. Res. 37(7):859-861.

Ivie, G. W. and D. L. Bull. 1976. Photodegradation of O-ethyl-O-[4-(methylthio) phenyl]S-propyl phosphorodithioate (BAY NTN 9306). J. Agric. Food Chem. 24(5):1053-1057.

Ivie, G. W. 1977. Metabolism of Insect Growth Regulators in Animals, pp. 111-125. In Ivie, G. W. and Dorough, H. W. (eds.). Fate of Pesticides in Large Animals, Academic Press, New York. 270 pp.

Ivie, G. W. and H. W. Dorough, (eds.). 1977. Fate of Pesticides in Large Animals. Academic Press, New York, 270 pp.

Ivie, G. W. 1978. Fate of diflubenzuron in cattle and sheep. J. Agric. Food Chem. 26(6):81-89.

Ivie, G. W. and J. E. Wright. 1978. Fate of diflubenzuron in the stable fly and house fly. J. Agric. Food Chem. 26:90-94.

Ivie, G. W. 1978. Toxicological Significance of Plant Furocoumarins, pp. 475-485. In Keeler, R. F., Van Kampen, K. R. and James, L. R. (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York, 600 pp.

Bull, D. L. and G. W. Ivie. 1978. Fate of Diflubenzuron in cotton, soil and rotational crops. J. Agric. Food Chem. 26:515-520.

Manners, G. D., G. W. Ivie and J. T. MacGregor. Mutagenic activity of hymenovin in Salmonella typhimurium: Association with the bis-hemiacetal functional group. Toxicol. Appl. Pharmacol. 45:629-633.

Ivie, G. W. 1978. Linear furocoumarins (psoralens) from the seed of Texas Ammi majus (Bishop's weed). J. Agric. Food Chem. 26:6:1394-1403.

Clark, D. E., G. W. Ivie, H. R. Crookshank, J. A. DeVaney and D. L. Bull. Effects of sulprofos and its sulfoxide and sulfone metabolites on laying hens fed the compounds in the diet. J. Agric. Food Chem. 27(1):103-107.

Ivie, G. W. 1980. Fate of diisopropyl methylphosphonate (DIMP) in a lactating cow. Bull. Environ. Contam. Toxicol. 24:40-48.

Ivie, G. W., D. L. Bull and J. A. Veech. 1980. Fate of diflubenzuron in water. J. Agric. Food Chem. 28(2):330-337.

Ivie, G. W. and L. M. Hunt. 1980. Metabolites of cis- and trans-permethrin in lactating goats. J. Agric. Food Chem. 28:1131-1138.

Ivie, G. W. 1980. Fate of the plant growth regulator Mefluidide (N-[2,4-dimethyl-5-[[(trifluoromethyl)sulfonyl]amino]phenyl]acetamide) in the cow and sheep. J. Agric. Food Chem. 28:1286-1288.

Ivie, G. W. and D. D. Oehler. Fate of dicyclopentadiene in a lactating cow. Bull. Environ. Contam. Toxicol. 24:662-670.

Ivie, G. W., J. T. MacGregor and B. D. Hammock. 1980. Mutagenicity of psoralen epoxides. Mutation Res. 79:73-77.

Ivie, G. W., D. L. Holt and M. C. Ivey. 1981. Natural toxicants in human foods: Psoralens in raw and cooked parsnip root. Science 213(21):909-910.

Ivie, G. W. and S. K. Bandal. 1981. Metabolic Aspects of Pesticide Toxicology, pp. 257-284. In Bandal, S. K., Marco, G. J., Golberg, L. and Leng, M. L. (eds.). The Pesticide Chemist and Modern Toxicology, ACS Symp. Ser. 160. 563 pp.

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Educational background. M.S., Animal Nutrition, Utah State University, 1957; Ph.D., Nutrition and Biochemistry, Utah State University, 1966.

Work experience.

1957-present Poisonous Plant Research Laboratory, ARS, USDA, Logan, UT
1955-1957 Utah Experiment Station
1953-1955 Utah Extension Service, Utah County Agricultural Agent in Charge of Livestock and 4H Club Programs

Area of research specialization. Research on poisonous plants.

Relevant publications (1975-present).

James, L. F., M. C. Williams and A. T. Bleak. 1976. Toxicity of Bassia hyssopifolia to sheep. J. Range Management 29:284-285.
James, L. F. and A. E. Johnson. 1976. Some major plant toxicities of the western United States. J. Range Management 29:356-363.
James, L. F. 1976. Effect of locoweed (Astragalus lentiginosus) feeding on fetal lamb development. Can. J. Comp. Med. 40:380-384.
James, L. F. and K. R. Van Kampen. 1976. The effect of locoweed toxin on rats. Am. J. Vet. Res. 37:845-846.
James, L. F., R. P. Sharma and J. D. Olsen. 1977. Locoweed poisoning in sheep: Electroencephalograph and brain amine charges. Clin. Toxiol. 11:53-60.
James, L. F., J. W. Call and A. H. Stevenson. 1977. Experimentally induced pine needle abortion in range cattle. Cornell Vet. 67:294-299.
James, L. F. 1977. Effects of milk from animals fed locoweed on kittens, calves, and lambs. Am. J. Vet. Res. 38:1263-1265.
James, L. F. 1977. Plant-Induced Congenital Malformations in Animals, pp. 208-222. In G. H. Baume (ed.). World Review of Nutrition and Dietetics - Human and Veterinary Nutrition. S. Karger, New York.
James, L. F., W. Foote, W. Nye and W. J. Hartley. 1978. Effects of feeding Ozytropis and Astragalus pollen to mice and Astragalus seeds to rats. Am. J. Vet. Res. 39:711-712.

James, L. F. 1978. Overview of Poisonous Plant Problems in the U.S., pp. 3-5. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

James, L. F. 1978. Oxalate Poisoning in Livestock, pp. 130-140. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

Williams, M. C. and L. F. James. 1978. Livestock Poisoning from Nitro-bearing Astragalus, pp. 379-389. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

Van Kampen, K. R. and L. F. James. 1978. Manifestation of Intoxication by Selenium-accumulating Plant Astragalus, pp. 135-138. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

Call, J. and L. F. James. 1978. Pine Needle Abortion in Cattle, pp. 587-590. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

Van Kampen, K. R., R. W. Rhees and L. F. James. 1978. Locoweed Poisoning in the United States, pp. 465-471. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

Hartley, W. J. and L. F. James. 1978. Summary of Experimental Astragalus lentiginosus Intoxication in the Pregnant Ewe, p. 368. In R. R. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

James, L. F. 1978. Livestock Poisoning by Plants, pp. 366-382. In D. C. Church (ed.). Digestive Physiology and Nutrition of Ruminants. D. C. Church.

Williams, M. C., L. F. James and B. O. Bond. 1979. Emory milkvetch (Astragalus emoryanus var emoryanus) poisoning in chicks, sheep, and cattle. Am. J. Vet. Res. 40(3):403-406.

James, L. F., W. J. Hartley, M. C. Williams and K. R. Van Kampen. 1980. Field and experimental studies in cattle and sheep poisoned by nitro bearing Astragalus or their toxins. Am. J. Vet. Res. 41(3):377-382.

James, L. F. 1980. Plant poisoning in livestock. Mod. Vet. Prac. 61:897-898.

James, L. F. 1980. Effects of poisonous plants on cattle. Am. Hereford J. 71:352-716.

James, L. F., W. J. Hartley and K. R. Van Kampen. 1981. Syndromes of Astragalus poisoning in livestock. J. Am. Vet. Med. Assoc. 178:146-150.

James, L. F. and J. L. Shupe. 1981. Selenium Accumulators, pp. 436-437. In J. L. Howard (ed.). Current Therapy in Food Animal Practice. W. B. Saunders, Inc., Philadelphia, PA.

James, L. F. and A. E. Johnson. 1981. Oxalate Accumulators, pp. 438-439. In J. L. Howard (ed.). Current Therapy in Food Animal Practice. W. B. Saunders, Inc., Philadelphia, PA.

James, L. F. and K. R. Van Kampen. 1981. Effects of Plant Toxins on the Central Nervous System, pp. 455-456. In J. L. Howard (ed.). Current Therapy in Food Animal Practice. W. B. Saunders, Inc., Philadelphia, PA.

James, L. F., J. L. Shupe and A. E. Johnson. 1981. Principal Poisonous Plant Problems in the Western United States, pp. 465-470. In J. L. Howard (ed.). Current Therapy in Food Animal Practice. W. B. Saunders, Inc., Philadelphia, PA.

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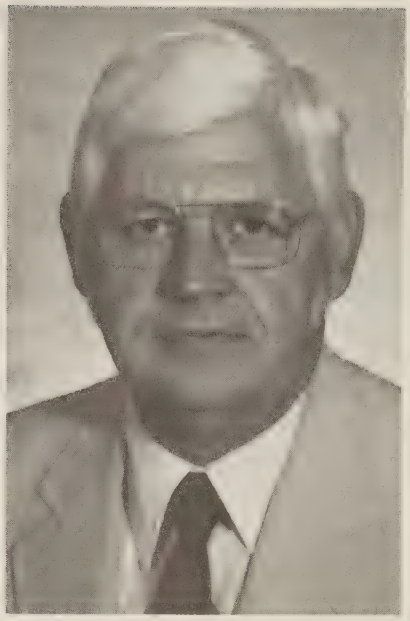

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Work experience.

1966-present Poisonous Plant Research Laboratory, ARS, USDA, Logan, UT
1957-1966 USDA, ARS, ADP
1952-1957 Research Associate, Utah State University Experiment Station

Area of research specialization. Toxicology of photosensitizing and hepatotoxic plants in livestock.

Relevant publications (1975-present).

Johnson, A. E. 1976. Effects on calves and rats of consuming milk from cows fed chronic lethal doses of *Senecio jacobaea* (tansy ragwort). Am. J. Vet. Res. 37(1):107-110.
Johnson, A. E., L. F. James and J. Spillett. 1976. The abortifacient and toxic effects of big sagebrush (*Artemisia tridentata*) and juniper (*Juniperus osteosperma*) on domestic sheep. J. Range Management 29(4):278-280.
Ivie, G. W., D. A. Witzel, W. Herz, R. P. Sharma and A. E. Johnson. 1976. Isolation of hymovin from *Hymenoxys richardsonii* (pingue) and *Dugaldia hoopesii* (orange sneezeweed). J. Agric. Food Chem. 24(3):681-682.
James, L. F. and A. E. Johnson. 1976. Some major plant toxicities of the western United States. J. Range Management 29(5):356-363.
Cronin, E. H., J. E. Bowns and A. E. Johnson. 1976. Herbicides, nitrogen, and control of tall larkspur under aspen trees. J. Range Management 39(6):420-422.
Johnson, A. E. 1978. Tolerance of cattle to *Senecio jacobaea*. Am. J. Vet. Res. 39(9):1542-1544.
Johnson, A. E. 1978. Tetrahymia Toxicity: A New Look at an Old Problem, pp. 209-216. *In* R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, Inc., New York.
Benson, J. M., J. N. Seiber, R. F. Keeler and A. E. Johnson. 1978. Studies on the Toxic Principle of *Asclepias eriocarpa* and *Asclepias labriformis*, pp. 273-284. *In* R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, Inc., New York.

Benson, J. M., J. N. Seiber, C. V. Bagley, R. F. Keeler, A. E. Johnson and S. Young. 1979. Effects of the milkweeds Asclepias eriocarpa and A. labriformis and of cardiac glycoside-containing derivative material on sheep. Toxicon 17:155-166.

Molyneux, R. J., A. E. Johnson, J. N. Roitman and M. E. Benson. 1979. Determination of pyrrolizidine alkaloid content and composition in Senecio species by nuclear magnetic resonance spectroscopy. J. Agric. Food Chem. 27(3):494-499.

Johnson, A. E. 1981. Dermatoxic Plants, pp. 452-455. In Current Veterinary Therapy in Food Animal Practice. W. B. Saunders Co., Philadelphia, PA.

James, L. F. and A. E. Johnson. 1981. Oxalate Accumulators, pp. 438-440. In Current Veterinary Therapy in Food Animal Practice. W. B. Saunders Co., Philadelphia, PA.

James, L. F., J. L. Shupe and A. E. Johnson. 1981. Principal Poisonous Plant Problems in Western United States, pp. 465-470. In Current Veterinary Therapy in Food Animal Practice. W. B. Saunders Co., Philadelphia, PA.

[illegible] C. V. Bailey, N. F. Angleton, A. [illegible]
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[illegible]ldeman, J. N. Roitman and M. E. [illegible]. 19
[illegible] of pyrrolizidine alkaloid content and [illegible]
[illegible]uclear magnetic resonance spectroscopy. [illegible]
[illegible]79.

[illegible] 1981. Dermatotoxic Plants, pp. 452-55. In [illegible]
Food Animal Practice. W. B. Saunders Co., Philadelphia.
[illegible]. E. Johnson. 1981. Oxalate Accumulators, pp. [illegible]
[illegible]rinary Therapy in Food Animal Practice. [illegible]
[illegible]ia, [illegible].

[illegible]. L. Maupe and A. E. Johnson. 1981. [illegible]
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Educational background: B.A., Psychology, University of Winnipeg, 1970; M.S., Toxicology, University of Guelph, 1975; D.V.M., Veterinary Medicine, University of Guelph, (Ontario Veterinary College, 1976.

Work experience.

1976-present Assistant Professor, Veterinary Physiology and Pharmacology, Texas A&M University, College Station, TX
1975-1976 Research Associate, University of Guelph, Metabolism of halogenated hydrocarbon compounds. Ecological effects of halogenated pollutants on aquatic animals and fish.
1973-1974 Research Assistant, University of Guelph, Effects of PCBs on mammalian biological systems.
1972-1973 Research Associate, University of Guelph, Research into effects of phthlate esters on biological systems.

Area of research specialization. Toxicology and Pharmacology.

Relevant publications (1975-present).

Jones, D.H., Ronald, K., Lavigne, D., Frank, R., Holdrinet, M. and Uthe, J. 1975. Biocide Residues in the Harp Seal (Pagophilus groenlandicus). International Council for the Exploration Sea. C.M. No. 11.
Jones, D.H., Platonow, N.S. and Safe, S. 1975. Contamination of Agricultural Products by Halogenated Biphenyls. Canadian Veterinary Journal. 16:No.12,349-356.
Ruzo, L.O., Safe, S., Hutzinger, O., Platonow, N.S. and Jones, D.H. 1975. Hydroxylated Metabolites of Chloronaphthalenes (Halowax 1030) in Pig Urine. Chemosphere. 3:121-123.
Safe, S., Hutzinger, O. and Jones, D.H. 1975. The Mechanism of Chlorobiphenyl in the Pig. J. Ag. Food Chem. 23:No.5, 851-853.
Safe, S., Ruzo, L.O. and Jones, D.H. 1975. The Metabolism of 4-Chlorobiphenyl in the Pig. Canadian J. Physio. and Pharm. 53:No.3,392-396.
Safe, S., Ruzo, L.O., Jones, D.H., Platonow, N.S., Hutzinger, O. and Sundstrom, G. 1975. The Metabolism of Polychlorinated Biphenyls. Eastern Canada Pesticide Analysis Conference, Toronto, Canada.
Sundstrom, G., Hutzinger, O., Safe, S., Ruzo, L. and Jones, D.H. 1975. Methods for the Study of Metabolism of Toxic and Persistant Chemicals in Aquatic Organisms as Exemplified by Chloronaphthalenes. In Sublethal Effects of Toxic Chemicals on Aquatic Animals. J.H. Koeman and J.J.T. W.A. Strik, editors. 177-188.

Jones, D.H., Ronald, K., Lavigne, D.M., Frank, R., Holdrient, M. and Uthe, J.F. 1976. Organochlorine and Mercury Residues in the Harp Seal (Pagophilis groenlandicus). Science of the Total Environment. 5: 181-195.

Ruzo, L.O., Safe, S., Jones, D.H. and Platonow, N. 1976. Uptake and Distribution of Chloronaphthalenes and Their Metabolites in Pigs. Bulletin of Environmental Contamination and Toxicology. 16:233-239.

Safe, S., Jones, D.H. and Hutzinger, O. 1976. Metabolism of 4-4' Dihalogenobiphenyls. Journal of the Chemical Society. Perkin I. 375-379.

Kohli, J., Safe, S. and Jones, D.H. 1976. The Metabolism of Higher Chlorinated Benzene Isomers. Canadian Journal Biochemistry. 54:No.3, 203-208.

Safe, S., Jones, D., Kohli, J., Ruzo, L.O., Hutzinger, O. and Sundstrom, G. 1976. The Metabolism of Chlorinated Aromatic Pollutants by the Frog. Canadian Journal Zoology, 54:No.11, 1818-1823.

Jones, D.H. 1976. PCB Synopsis. J.A.V.M.A. 169:No.11, 1216.

Jones, D.H., Lewis, D.H., Eurell, T.E. and Cannon, M.S. 1979. Alteration of the Immune Response of Channel Catfish (Ictalurus punctatus) by Polychlorinated Biphenyls. In Proceedings of the International Symposium of Pathobiology of Environmental Pollutants - Animal Models and Wildlife as Monitors.

Jones, D.H. 1978. Testing Chemicals for Carcinogenicity, Mutagenicity and Teratogenicity: In Vitro and In Vivo Testing, Limitations. Center for Professional Advancement.

Jones, D.H. 1979. Testing Chemicals for Mutagenesis and Carcinogenesis. Center for Professional Advancement.

Jones, D.H., Kohli, J. and Safe, S. 1979. Avian Metabolism of halogenated Biphenyls. Xenobiotica. 9:No.12, 733-736.

Herrig, B.W. and Jones, D.H. 1980. Utilization of the Escherichia Coli Pol A Test: An Adjunct to the Ames Assay. Veterinary and Human Toxicology, 22:No.5, 326-328.

Jones, D.H. 1981. The Role of Plasma Kinins in Anaphylaxis. Veterinary and Human Toxicology. 23:No.4, 265-276.

Jones, D.H. and Kim, H.L. 1981. Toxicity and Mutagenicity of Hymenoxon: A Sesquiterpene Lactone. Toxicology Letters. (In press).

Jones, D.H. and Amoss, M.S. 1981. Cell-Mediated Immune Response in Minature Swine With Cutaneous Melanomas. Cancer Letters. (Submitted).

Jones, D.H. and Kim, H.L. 1981. Toxicity of Hymenoxon in Swiss White Mice Following Pretreatment with Microsomal Enzyme Inducers, Inhibitors and Carbon Tetrachloride. Res. Comm. Chem. Pathol. and Pharmacol. (In press).

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Work experience.

1965-present Poisonous Plant Research Laboratory, ARS, USDA, Logan, UT
1961-1965 Research Chemist, National Animal Disease Laboratory, Ames, IA
1957-1961 Assistant Biochemist, Montana Veterinary Research Laboratory, Montana State College
1954-1957 Research Fellow in Biochemistry, Ohio State University, Department of Agricultural Biochemistry

Area of research specialization. Structure, distribution, and mode of action of teratogens and toxins from poisonous plants.

Relevant publications (1975-present).

Keeler, R. F., R. S. Young, R. S. Spendlove, D. R. Douglas and G. F. Stallknecht. 1975. Occurrence of spontaneous hemorrhagic necrosis of the central nervous system of fetal hamsters. Teratology 11:21-30.

Keeler, R. F. 1975. Toxins and teratogens of higher plants. Lloydia 38:56-86.

Keeler, R. F., D. R. Douglas and G. F. Stallknecht. 1975. The testing of blighted, aged, and control Russet Burbank tuber preparation inability to produce spina bifida and anancephaly in rats, rabbits, hamsters, and mice. Am. Potato J. 52:125-132.

Keeler, R. F. 1975. Review of the book "Poisonous Plants of Australia," by Selwyn Everist. J. Range Management 28:503.

Keeler, R. F., S. Young and D. Brown. 1976. Spina bifida, exencephaly, and cranial bleb produced in hamsters by the solanum alkaloid solasodine. Res. Comm. Chem. Path. Pharm. 13:723-731.

Keeler, R. F., D. Brown, D. Douglas, G. Stallknecht and S. Young. 1976. Teratogenicity of the solanum alkaloid solasodine and of 'Kennebec' potato sprouts in hamsters. Bull. Environ. Contam. Toxicol. 15:522-524.

Keeler, R. F. 1976. Lupin alkaloids from teratogenic and non-teratogenic lupins. III. Identification of anagyrine as the probable teratogen by feeding trials. J. Tox. Environ. Health 1:887-898.

Keeler, R. F., E. H. Cronin and J. L. Shupe. 1976. Lupin alkaloids from teratogenic and non-teratogenic lupins. IV. Concentration of total alkaloids, individual major alkaloids, and the teratogen anagyrine as a function of plant part and stage of growth and their relationship to crooked calf disease. J. Tox. Environ. Health 1:889-908.

Keeler, R. F., L. F. James, J. L. Shupe and K. R. Van Kampen. 1977. Lupine-induced crooked calf disease and a management method to reduce incidence. J. Range Management 30:97-102.

Keeler, R. F. and L. D. Balls. 1977. Teratogenic effects in cattle of Conium maculatum and conium alkaloids and analogs. Clin. Toxiol. 12:49-64.

Keeler, R. F. 1978. Alkaloid Teratogens from Lupinus, Conium, Veratrum, and Related Genera, pp. 397-408. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

Keeler, R. F., S. Young, D. Brown, G. F. Stallknecht and D. Douglas. 1978. Congenital deformities produced in hamsters by potato sprouts. Teratology 17:327-334.

Keeler, R. F. and S. Young. 1978. Multifactorial contributions to the etiology of spontaneous hemorrhagic necrosis of the central nervous system of fetal hamsters. Teratology 17:285-292.

Keeler, R. F. 1978. Reducing incidence of plant-caused congenital deformities in livestock by grazing management. J. Range Management 31:355-360.

Keeler, R. F., K. R. Van Kampen and L. F. James (eds.). 1978. Effects of Poisonous Plants on Livestock. Academic Press, Inc., New York. 600 pp.

Keeler, R. F. 1978. Cyclopamine and related steroidal alkaloid teratogens: Their occurrence, structural relationship, and biologic effects. Lipids 13:708-715.

Keeler, R. F. and S. Young. 1979. Role of Vitamin E in the etiology of spontaneous hemorrhagic necrosis of the central nervous system of fetal hamsters. Teratology 20:127-132.

Keeler, R. F. 1979. Congenital defects in calves from maternal ingestion of Nicotiana glauca of high anabasine content. Clin. Toxiol. 15:417-426.

Keeler, R. F. 1979. Toxins and Teratogens of the Solanaceae and Liliaceae, pp. 59-82. In D. Kingham (ed.). Toxic Plants. Columbia University Press, Irvington, NY.

Keeler, R. F., L. D. Balls, and J. L. Shupe and M. W. Crowe. 1980. The toxicity and teratogenicity of coiine in cows, ewes, and mares. Cornell Vet. 70:19-26.

Keeler, R. F. and R. Gross. 1980. The total alkaloid and anagyrine content of some bitter and sweet selections of lupine species used as food. J. Environ. Path. Toxicol. 3(5/6):333-340.

Keeler, R. F. 1980. Plant Toxins, pp. 285-322. In A. T. Tu (ed.). Survey of Contemporary Toxicology, Vol. I. Wiley-Interscience, New York.

Keeler, R. F. and J. L. Shupe. 1981. Teratogenic Plants, pp. 457-459. In J. L. Howard (ed.). Current Veterinary Therapy in Food Animal Practice. W. B. Saunders, Philadelphia, PA.

Keeler, R. F., L. D. Balls and K. Panter. 1981. Teratogenic effects of Nicotiana glauca and concentration of anabasine, the suspect teratogen, in plant parts. Cornell Vet. 71:47-53.

Keeler, R. F. and M. W. Crowe. 1981. Congenital deformities in livestock induced by maternal Nicotiana ingestion. Teratology 23:44A.

Keeler, R. F., J. L. Shupe, M. W. Crowe, A. Olsen and L. D. Balls. 1981. Nicotiana glauca induced congenital deformities in calves: Clinical and pathologic aspects. Am. J. Vet. Res. 42(7):1231-1234.

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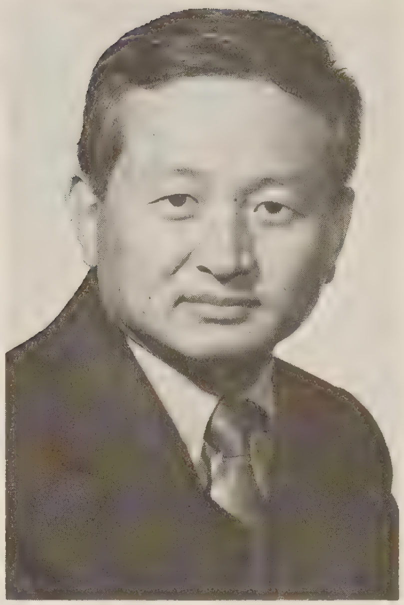

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Area of research specilization. Natural Products Chemistry, Biochemistry and Toxicology.

Relevant publications (1975-present).

Kim, H.L., Rowe, L.D. and Camp, B.J. 1975. Hymenoxon, a Poisonous Sesquiterpene Lactone From Hymenoxys odorata DC (Bitterweed). Research Communications in Chemical Pathology and Pharmacology. 11:647.
Pettersen, R.C. and Kim, H.L. 1976. The X-Ray Structures of Hymenoxon and Hymenolane; Pseudoguaianolides Isolated From Hymenoxys odorata DC (Bitterweed). J. Chem. Soc. Perkin II:1399.
Hill, D.W., Kim, H.L., Martin, C.L. and Camp, B.J. 1977. Identification of Hymenoxon in Baileya multiradiata and Helenium hoopsii. J. Ag. Food Chem. 25:1304.
Hill, D.W., Kim, H.L. and Camp, B.J. 1979. Quantitative Analysis of Hymenoxon in Plant Tissue. J. Ag. Food Chem. 27:885.
Rowe, L.D., Kim, H.L. and Camp, B.J. 1980. The Antagonistic Effect of L-Cysteine in Experimental Hymenoxon Intoxication in Sheep. Am. J. Vet. Res. 41:484.
Kim, H.L. 1980. Toxicity of Sesquiterpene Lactones. Res. Comm. Chem. Path. Pharmacol. 28:189.
Terry, M.K., Kim, H.L., Corrier, D.E. and Bailey, E.M. 1981. The Acute Oral Toxicity of Hymenoxon in Sheep. Res. Comm. Chem. Path. Pharmacology. 31:181.
Lee, K.H., Ibuka, T., Sims, D., Muraoka, O., Koyokawa, H., Hall, I.H. and Kim, H.L. 1981. Antitumor Agents. 44. Bishelenalinyl Esters and Related Derivatives as Novel Potent Antileukemic Agents. J. Med. Chem.(In press).

Jones, D.H. and Kim, H.L. 1981. Toxicity of Hymenoxon in Swiss White Mice Following Pretreatment with Microsomal Enzyme Inducers, Inhibitors and Carbon Tetrachloride. Res. Comm. Chem. Pathol. Pharmacol. (In press).

Jones, D.H. and Kim, H.L. 1981. Toxicity and Mutagenecity of Hymenoxon, A Sesquiterpene Lactone. Toxicology Letters. (In press).

Kim, H.L., Anderson, A.C., Terry, M.K. and Bailey, E.M. 1981. Protective Effect of Butylated Hydroxyanisole on Acute Hymenoxon and Bitterweed Poisoning. Res. Comm. Chem. Pathol. Pharmacol. (In press).

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Area of research specialization. Poultry toxicology; Nutrition and biochemistry.

Relevant publications (1975-present).

Kubena, L. F., C. R. Sadler, R. L. Haynes, T. H. Vardaman and J. W. Deaton. 1976. Effect of fish and poultry byproduct meal on the small intestine and gizzard of broilers. Poult. Sci. 55(1):30-33.
Deaton, J. W., F. N. Reece, L. F. Kubena and J. D. May. 1976. Effect of varying light intensity on broiler performance. Poult. Sci. 55(2):515-519.
Deaton, J. W., J. D. May, L. F. Kubena and F. N. Reece. 1976. Physiological changes associated with acclimation of broiler chickens to constant temperatures. Int. J. Biometeorol. 20(4):333-336.
McNaughton, J. L., L. F. Kubena, J. W. Deaton and F. N. Reece. 1977. Influence of dietary protein and energy on the performance of commercial egg-type pullets reared under summer conditions. Poult. Sci. 56(5):1391-1398.
Deaton, J. W., L. F. Kubena, F. N. Reece and B. D. Lott. 1977. Effect of dietary fiber on the performance of laying hens. Br. Poult. Sci. 18:711-714.

Crookshank, H. R., B. A. Sowa, L. F. Kubena, G. M. Holman, H. E. Smalley and R. K. Morrison. 1978. Effect of diflubenzuron (Dimilin; TH-6040) on the hyaluronic acid concentration in chicken combs. Poult. Sci. 57(3):804-806.

Kubena, L. F. and S. J. Cysewski. 1979. Influence of various levels of vanadium on the growing chick. Poult. Sci. 58:1075-1076.

Kubena, L. F., T. D. Phillips, D. A. Witzel and N. D. Heidelbaugh. 1980. Influence of vanadium on female laying strain chickens. Poult. Sci. 59(7):1628-1629.

Quarles, J. M., J. O. Norman and L. F. Kubena. 1980. Absence of transformation by diflubenzuron in a host-mediated transplacental carcinogen assay. Bull. Environm. Contam. Toxicol. 25:252-256.

Kubena, L. F., H. E. Smalley and F. M. Farr. 1981. Influence of glyphosate (N-(phosphomethyl)glycine) on performance and selected parameters in broilers. Poult. Sci. 60(1):132-136.

Kubena, L. F. 1981. The influence of diflubenzuron on several weight characteristics in growing male broiler and layer breed chickens. Poult. Sci. 60(6):1175-1182.

Phillips, T. D., G. W. Ivie, N. D. Heidelbaugh, L. F. Kubena, S. J. Cysewski, A. W. Hayes and D. A. Witzel. 1981. Confirmatory test for the mycotoxin penicillic acid utilizing high pressure liquid and gas liquid chromatographic analysis. J. Assoc. Off. Anal. Chem. 64(1):162-165.

Phillips, T. D., B. R. Nechay, L. F. Kubena, N. D. Heidelbaugh, E. C. Shepherd, A. R. Stein, S. L. Neldon and D. A. Witzel. 1981. Effects of calcium ortho-vanadate on NA^+ - K^+ adenosine triphosphatase activities in the chicken. Toxicologist 1:119.

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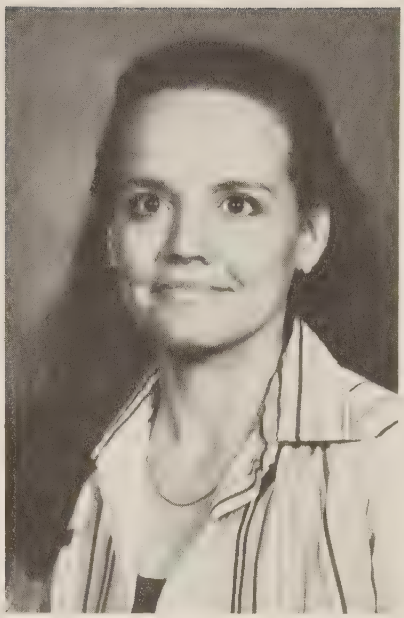

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Relevant publications (1975-present).

Anderson, A. D. and S. L. Lovering. 1977. Basic Concepts in Pathology: A Laboratory Manual, University of Wyoming, Laramie, WY. 160 pp.

Lovering, S. L., S. A. Benjamin, A. M. Hargis and R. W. Thomassen. 1979. Malignant lymphomas occurring in beagles exposed to low-level radiation. HEW Publications (FDA) 79-8042, #8. pp. 35-39.

Lovering, S. L., A. M. Hargis, S. A. Benjamin and R. W. Thomassen. 1979. Gross and surgical pathological findings in beagles receiving gamma radiation during development and sacrificed at 8 years of age. HEW Publications (FDA) 79-8042, #6. pp. 24-30.

Hargis, A. M., S. L. Lovering, S. A. Benjamin and R. W. Thomassen. 1979. Long-term segment III beagles scheduled for sacrifice: A progress report. HEW Publication (FDA) 79-8042, #5. pp. 21-23.

Hargis, A. M., S. L. Lovering, S. A. Benjamin, A. C. Lee, R. D. Brewster, R. K. Brooks and R. W. Thomassen. Principal disease or cause of death in nonsacrifice segment III beagles of the CRHL long-term study. HEW Publication (FDA) 79-8042, #4. pp. 11-20.

Benjamin, S. A., A. M. Hargis, S. L. Lovering, R. W. Thomassen, G. M. Angleton, A. C. Lee, R. D. Brewster and R. K. Brooks. 1979. Malignancy as a cause of death in nonsacrifice segment III beagles receiving gamma radiation during development. HEW Publication (FDA) 79-8042, #7. pp. 31-34.

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[illegible] and S. L. Lovering. 1977 [illegible]
[illegible] Manual, University of Wyoming, Laramie.
[illegible] L., S. A. Benjamin, A. M. Hargis and R. W. [illegible]
[illegible] of lymphomas occurring in beagles exposed [illegible] radiation.
[illegible] (FDA) 79-8042, #8. pp. 35-39.
[illegible] A. M. Hargis, S. A. Benjamin and R. W. [illegible]
[illegible] surgical pathological findings in beagles receiving [illegible]
[illegible] during development and sacrificed at 8 years of age.
[illegible] (FDA) 79-8042, #6. pp. 24-30.
[illegible] S. L. Lovering, S. A. Benjamin and R. W. Thomassen. 1979.
[illegible] segment I beagles scheduled for sacrifice: A progress report.
[illegible] (FDA) 79-8042. #5. pp. 21-23.
[illegible] S. L. Lovering, S. A. Benjamin, A. C. Lee, [illegible] D. Brewster, R. R.
[illegible] Principal disease or cause of death in
segment III beagles [illegible] the CRHL long-term study. HEW
(FDA) 79-8042 #4. pp. 11-20.
[illegible] S. L. Lovering, R. W. Thomassen, G. M. Angleton,
[illegible] and R. K. Brooks. 1979. Malignancy as [illegible]
[illegible] beagle receiving gamma radiation
[illegible] (FDA) 79-8042. #7. pp. 31-34.

Benjamin, S. A., V. M. Johnson, A. M. Hargis, S. L. Lovering, R. W. Thomassen, R. D. Brewster and R. K. Brooks. 1979. Mammary neoplasia in beagles exposed to gamma radiation during development. HEW Publication (FDA) 79-8042, #11. pp. 51-54.

Lovering, S. L., K. R. Pierce and L. G. Adams. 1980. Serum complement and blood platelet adhesiveness in acute canine ehrlichiosis. Am. J. Vet. Res. 41(8):1266-1271.

. 1. Johnson, A. N. [illegible] ia, S. L. Lovering, R. W. Thomassen, and R. K. Brooks. 1979. Mammary neoplasia in beagles [illegible] gamma radiation during development. [illegible] pp. 51-54

... [illegible] R. Pierce and L. G. Adams. 1981. Serum complement [illegible] [illegible] eiveness in acute canine ehrlichiosis. Am. [illegible] 42:1265-[illegible]

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Relevant publications (1975-present).

Meola, S. M. and J. A. DeVaney. 1976. Parasitism of mallophaga by Trenomyces histophtorus (Chatton & Picard) Laboulbeniales. Invert. Pathol. 28:195-201.
Olson, J. K. and S. M. Meola. 1976. Variations in chorionic sculpturing of eggs of Aedes sollicitans (Walker). Ann. Entomol. Soc. Am. 69(1):96-100.
Norman, J. O., J. H. Johnson, H. H. Mollenhauer and S. M. Meola. 1976. Effects of sesquiterpene lactones on the growth of Bacillus thuringiensis. Antimicrob. Agents Chemother. 9(3):535-539.
Wheeler, M. H., W. J. Tolmsoff and S. M. Meola. 1976. Ultrastructure of melanin formation in Verticillium dahlia with (+)-scytalone as a biosynthetic intermediate. Can. J. Microbiol. 22(5):702-711.
Meola, S. M., H. H. Mollenhauer and J. M. Thompson. 1977. Cytoplasmic bridges within the follicular epithelium of the ovarioles of two diptera, Aedes aegypti and Stomoxys calcitrans. J. Morphol. 153(1):81-86.
Meola, R. W., R. L. Harris, S. M. Meola and D. D. Oehler. 1977. Dietary-induced secretion of sex pheromones and development of sexual behavior in the stable fly. Environ. Entomol. 6(6):895-897.
Thompson, J. M., S. M. Meola, R. L. Ziprin and E. L. Jeska. 1977. An ultrastructural study of the invasion of Ascaris suum larvae by neutrophils. J. Invert Pathol. 30:181-184.

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S. M. Meola. 1976. Variations in
solicitans (Walker). Ann. Entomol.
. Johnson, M. M. Wittenmeyer and S.
lactones on the growth of Bacillus thuringiensis
Agents Chemother. 9(3) 535-539.
J. Tolmsoff and S. M. Meola. 1976. Ultrastructure
in Verticillium dahlia with (+)-scytalone as a
intermediate. Can. J. Microbiol. 22(5) 702-711
Mollenhauer and J. M. Thompson. 1977. Cytochemistry
icular epithelium of the ovarioles of two Diptera.
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and D. O. Dahler. 1977. Dietary
hormones and development of sexual behavior
1977. A
of Aedes aegypti larvae by

Leopold, R. A., S. M. Meola and M. E. Degrugillier. 1978. The egg fertilization site within the housefly, Musca domestica (L.) (Diptera:Muscidae). Int. J. Insect Morphol. Embryol. 7(2):111-120.

Blake, B. H., D. E. Bay, S. M. Meola and M. A. Price. 1978. Morphology of the mouthparts of the sheet scab mite, Psoroptes ovis. Ann. Entomol. Soc. Am. 71(3):289-294.

Meyer, R. E. and S. M. Meola. 1978. Morphological characteristics of leaves and stems of selected Texas woody plants. USDA Tech. Bull. #1564. 200 pp.

Cook, B. J. and S. M. Meola. 1978. The oviduct musculature of the horsefly, Tabanus sulcifrons, and its response to 5-hydroxytryptamine and proctolin. Physiol. Entomol. 3:273-280.

Cook, B. J. and S. M. Meola. 1978. Neural networks and the origin of spontaneous postsynaptic potentials in the visceral muscles of the hindgut of an insect. J. Gen. Physiol. 72:4a-5a.

Mayer, R. T., S. M. Meola, D. L. Coppage and J. R. DeLoach. 1979. The pupal instar of Stomoxys calcitrans: Cuticle deposition and chitin synthesis. J. Insect Physiol. 25:677-683.

Bohmfolk, G. T., M. A. Price and S. M. Meola. 1979. Chaetotactic and morphologic comparisons in larval Boophilus annulatus (Say) and Boophilus microplus (Canestrini) (Acarina:Ixodidae). Southwest. Entomol. 4(2):102-116.

Meola, S. M. and R. T. Mayer. 1980. Inhibition of cellular proliferation of epidermal cells by diflubenzuron in pupae of stable fly. Science. 207:985-987.

Mayer, R. T., S. M. Meola, D. L. Coppage and J. R. DeLoach. 1980. Utilization of imaginal tissues from pupae of the stable fly for study of chitin synthesis and screening of chitin synthesis inhibitors. J. Econ. Entomol. 73(1):76-80.

Thompson, P. H., S. M. Meola and J. M. Thompson. 1980. Dead-end parasitism of Bomnbyliid larvae in Tabanid adults. Southwest. Entomol. 5(1):12-15.

DeLoach, J. R., S. M. Meola, R. T. Mayer and J. M. Thompson. 1981. Inhibition of DNA synthesis by diflubenzuron in pupae of the stable fly Stomoxys calcitrans (L.). Pesticide Biochem. Physiol. 15:172-180.

DeLoach, J. R., S. M. Meola and R. T. Mayer. 1981. Effect of diflubenzuron on thymidine incorporation in Stomoxys calcitrans pupae. Southwest. Entomol. 6(2):123-125.

Mayeux, H. S., Jr., W. R. Jordon, R. E. Meyer and S. M. Meola. 1981. Epicuticular wax on goldenweed (Isocoma spp.) leaves: Variation with species and season. Weed Sci. 29:389-393.

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Area of research specialization. Electron microscopy, male reproduction, cellular secretion.

Relevant publications (1975-present).

Mollenhauer, H. H. 1975. Poststaining sections for electron microscopy: An alternate procedure. Stain Technol. 50(4):292.
Mollenhauer, H. H., J. H. Johnson, R. L. Younger and D. E. Clark. 1975. Ultrastructural changes in liver of the rat fed hexachlorobenzene. Am. J. Vet. Res. 36(12):1777-1781.
Mollenhauer, H. H. 1976. Improved specimen lighting in ultramicrotomy by painting reflective surfaces on specimen blocks. J. Microsc. 107(2):203-204.
Mollenhauer, H. H. and D. J. Morré. 1976. Cytochalasin B, but not colchicine, inhibits migration of secretory vesicles in root tips of maize. Protoplasma 87:39-48.

Mollenhauer, H. H., B. S. Hass and D. J. Morré. 1976. Membrane transformations in Golgi apparatus of rat spermatids. A role for thick cisternae and two classes of coated vesicles in acrosome formation. J. Microsc. Biol. Cell. 27(1):33-36.

Mollenhauer, H. H., J. H. Johnson, R. L. Younger and D. E. Clark. 1976. A unique intracellular aberration related to hexachlorobenzene ingestion. Am. J. Vet. Res. 37(7):847-850.

Davidson, K. L., H. H. Mollenhauer, R. L. Younger and J. H. Cox. 1976. Mirex-induced hepatic changes in chickens, Japanese quail, and rats. Arch. Environ. Contam. Toxicol. 4(4):469-482.

Mollenhauer, H. H. and D. J. Morré. 1977. Dictyosome-like structures with cylindrical intersaccular connections (microtubules?) in guinea pig spermatocytes. Am. J. Anat. 150(3):381-393.

Mollenhauer, H. H., D. J. Morré and B. S. Hass. 1977. Plasma membrane transformations in spermatogenesis revealed by aldehyde fixatives containing tannic acid. J. Ultrastruct. Res. 61:166-171.

Mollenhauer, H. H. 1978. Improved technique for pipetting solutions during tissue processing for electron microscopy. J. Microsc. 113(2):215-216.

Mollenhauer, H. H. and D. J. Morré. 1978. Polyribosomes associated with forming acrosome membranes in guinea pig spermatids. Science 200(4337):85-86.

Mollenhauer, H. H. and D. J. Morré. 1978. Structural differences contrast higher plant and animal Golgi apparatus. J. Cell Sci. 32:357-362.

Witzel, D. A., M. D. Springer and H. H. Mollenhauer. 1978. Cone and rod photoreceptors in the white-tailed deer (Odocoileus virginianus). Am. J. Vet. Res. 39(4):699-701.

Morré, D. J., H. H. Mollenhauer and C. M. Eppler. 1980. Cytochemical demonstration of NADH-ferricyanide reductase and nucleoside diphosphatase activities in dictyosome-like-structures of guinea pig spermatocytes. Cell Tissue Res. 211:65-72.

Mollenhauer, H. H. and R. E. Droleskey. 1980. Some specific staining reactions of potassium ferricyanide in cells of guinea pig testes. J. Ultrastruct. Res. 72:385-391.

Costa, M. and H. H. Mollenhauer. 1980. Phagocytosis of nickel subsulfide particles during the early stages of neoplastic transformation in tissue culture. Cancer Res. 40:2688-2694.

Costa, M. and H. H. Mollenhauer. 1980. Carcinogenic activity of particulate nickel compounds is proportional to their cellular uptake. Science 209:515-517.

Cannon, M. S., H. H. Mollenhauer, T. E. Eurell, D. H. Lewis, A. M. Cannon and C. Tompkins. 1980. An ultrastructural study of the leukocytes of the channel catfish, Ictalurus punctatus. J. Morphol. 164:1-23.

Mollenhauer, H. H., L. D. Rowe, S. J. Cysewski and D. A. Witzel. 1981. Ultrastructural observations in ponies after treatment with monensin. Am. J. Vet. Res. 42(1):35-40.

DeLoach, J. R., H. H. Mollenhauer and R. T. Mayer. 1981. Isopycnic centrifugation of acidic glycosidases and acid phosphatase containing particles from Stomoxys calcitrans. Comp. Biochem. Physiol. 69B:279-282.

, H. H., B. S. Hess and D. J. Morré. 76. brane
ommations in Golgi apparatus of 1981
and two classes of coat vesicles crosome forma
Biol. Cell. 27(1):33-36.
H., J. H. Johnson, R. L.
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Res. 37(7):847-850.
, H. H. Mollenhauer.
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, H., D. J. Morré and E.
ormations in spermatogenes
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, H. H. 1978. Improved techni
processing for electron micr
, H. H. and D.
ng acrosome membranes
57):64-
, H. H. and D.
plant and animal Golgi
, M. D. Smith and E.
receptors the white-tailed deer
Res. 29(4):699-701.
J. H. H. Mollenhauer and
station of NADH-ferricyanide reductase
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Tissue Res. 211:65-72.
, H. H. and R. E. Droleskey.
tors of potassium ferricyanide in cells
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and H. H. Mollenhauer 1980. Phagocytes
les during the early stages of neoplastic tran
e. Cancer Res. 40:2688-2694.
H. H. Mollenhauer. 1980. Carcinogenic ctivity
ounds is proportional to their cellular
, H. H. Mollenhauer, T. E. Burell, D. H. Lewis, A. M.
ns. 1980. An ultrastructural study of the leukocytes
catfish Ictalurus punctatus. J. Morphol.
H. H. . D. Rowe, S. J. Cysewski and D. A. Witzel.
ctural observations in ponies after treatment with
L. Res. 42(1):35-40.
. Mollenhauer and R. T. Mayer. 1981. Isozyme
cidic glycosidases and acid phosphatase
oxys calcitrans. Comp. Biochem. Physiol.

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Work experience.

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1953-1958 Microbiologist, VA Hospital, Houston, TX
1951-1953 Research Scientist, University of Texas, M.D. Anderson Hospital for Cancer Research, Houston, TX

Area of research specialization. Host parasite relationships.

Relevant publications (1975-present).

Ivie, G. W., D. A. Witzel, W. Herz, R. Nannan, J. O. Norman, D. Rushing, J. H. Johnson, L. D. Rowe and J. A. Veech. 1975. Hymenovin: major toxic constituent of western bitterweed (Hymenoxys odorata DC.) J. Agric. Food Chem. 23(5):841-845.
Younger, R. L., J. E. Wright, H. E. Smalley, H. R. Crookshank and J. O. Norman. 1975. Effects of 5 juvenile hormone analogues applied topically to cattle naturally infested with Hypoderma larvae (Diptera:Oestridae.). J. Med. Entomol. 12(5):517-524.
Norman, J. O., J. H. Johnson, H. H. Mollenhauer and S. M. Meola. 1976. Effects of sesquiterpene lactones on the growth of Bacillus thuringiensis. Antimicrob. Agents Chemother. 9(3):535-539.
Stearman, W. C., J. O. Norman and D. V. Petersen. 1976. Microapplicator and micropipet for inoculation of the embryonated chick egg. Appl. Microbiol. 31(4):621-622.
Doyle, J. J., W. C. Stearman, J. O. Norman and H. D. Peterson. 1977. Effects of aflatoxin B_1 on distribution of Fe, Cu, Zn, and Mn in rat tissues. Bull. Environ. Contam. and Toxicol. 17(1):33-39.

Norman, J. O. and M. H. Elissalde. 1979. Abortion in laboratory animals induced by *Moraxella bovis*. Infect. and Immun. 24(2):427-433.

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1972-present Veterinary Medical Officer, Poisonous Plant Research Laboratory, ARS, USDA, Logan, UT
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1967-1968 Senior Research Fellow, Department of Physiology, School of Medicine, University of Washington, Seattle, WA
1962-1966 Research Veterinarian, Physiopathology Section of National Animal Disease Laboratory, Ames, IA
1961-1962 Instructor of Clinical Medicine, College of Veterinary Medicine, University of Minnesota, St. Paul, MN

Area of research specialization. Pathophysiology in livestock due to plant toxicosis.

Relevant publications (1975-present).

Olsen, J. D. 1977. A rat bioassay for estimating toxicity of plant material from larkspur (Delphinium sp.). Am. J. Vet. Res. 28:277.
James, L. F., J. D. Olsen and R. P. Sharma. 1977. Locoweed poisoning in sheep: Electroencephalographic and brain amine changes. Clin. Toxicol. 11:53-60.
Olsen, J. D. 1977. Toxicity of extract from three larkspur species measured by rat bioassay. J. Range Management 30(3):237.
Olsen, J. D. 1977. Unlocking the secrets of larspur. Utah Science 38:35-38.
Anderson, M. J., R. C. Lamb, C. H. Mickelsen, J. T. Blake, J. D. Olsen and C. W. Arave. 1977. Facility for exercising dairy cows. J. Dairy Sci. 60:1173-1175.
Olsen, J. D. 1978. Tall larkspur poisoning in cattle and sheep. J. Am. Vet. Med. Assoc. 173(6):762-765.
Olsen, J. D. 1978. Larkspur Toxicosis: A Review of Current Research, pp. 535-543. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.

Olsen, J. D. 1979. Method for repeated or prolonged rumen infusion without establishing an open fistula. Am. J. Vet. Res. 40:730-732.

James, L. F., R. F. Keeler, A. E. Johnson, M. C. Williams, E. H. Cronin and J. D. Olsen. 1980. Plants poisonous to livestock in the western states. USDA, ARS. Information Bull. #415. 90 pp.

Cronin, E. H., M. C. Williams and J. D. Olsen. 1981. Toxicity and control of kelsey milkvetch. J. Range Management 34(4):181-183.

Pelletier, S. W., O. D. Dailey, Jr., N. V. Mody and J. D. Olsen. 1981. Isolation and structure elucidation of the alkaloids of Delphinium glaucescens rybd. J. Org. Chem. 46:3284-3293.

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Veterinary Public Health
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Educational background: B.S., Chemistry, Mississippi State University, 1970; M.S., Chemistry, University of Southern Mississippi, 1972; Ph.D., Chemistry, University of Southern Mississippi, 1975.

Work experience.

1979-present Assistant Professor, Department of Veterinary Public Health, College of Veterinary Medicine, Texas A&M University, College Station, Texas
1976-1979 Research Associate, Department of Pharmacology and Toxicology, University of Mississippi Medical Center, Jackson, Mississippi
1975-1976 Welch Foundation Fellow, Baylor College of Medicine, Texas Medical Center, Houston, Texas
1972-1975 Research Assistant and N.D.E.A. Fellow, Department of Chemistry, University of Southern Mississippi
1971-1972 N.D.E.A. Fellow, Department of Chemistry, University of Southern Mississippi

Area of research specilization. Molecular Toxicology (Mycotoxins)

Molecular and kinetic evaluation of the mechanisms involved in the toxic actions of the mycotoxins, corresponding metabolites, and polysubstituted derivatives (especially those compounds containing conjugated lactone functionalities).

Relevant publications (1975-present).

Phillips, T.D. and Hayes, A.W. 1977. Inhibition of In Vitro Adenosine Tri-Phosphatase Activities In The Mouse by Patulin. Fed. Proc. 36:1008.
Phillips, T.D., Hayes, A.W., Ho, I.K. and Desaiah, D. 1978. Effects of Rubratoxin B on the Kinetics of Cationic and Substrate Activation of Na^+ -K^+ ATPase and Para Nitrophenyl Phosphatase Activities. Fed. Proc. 37:501.
Desaiah, D, Phillips, T.D., Hayes, A.W. and Ho, I.K. 1978. Effects of Aflatoxins on ATPase Activities in Rat and Mouse Tissues. Fed. Proc. 37:502.
Hayes, A.W., Phillips, T.D. and Williams, L. 1978. Acute Toxicity of Patulin. Presented at the Seventeenth Annual Meeting of the Society of Toxicology, San Francisco, CA.
Phillips, T.D., Chan, P.K. and Hayes, A.W. 1979. Inhibitory Characteristics of the Mycotoxin Penicillic Acid on (Na^+ -K^+-aAdenosine Triphosphatase. Presented at the Eighteenth Meeting of the Society of Toxicology, New Orleans, LA.

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[illegible] Meeting of the Society of Toxicol-

Chan, P.K., Phillips, T.D. and Hayes, A.W. 1979. In Vitro and In Vivo Effects of Penicillic Acid on Adenosine Triphosphatase Activities in Mouse. Presented at the Eighteenth Meeting of the Society of Toxicology, New Orleans, LA.

Phillips, T.D. and Hayes, A.W. 1979. Polyfunctional Rubratoxin B: Radiotoxin Binding and Effects of Structural Modification on Membrane ATPase. Presented at the 63rd Meeting of the Federation of American Societies for Experimental Biology, Dallas, TX.

Siraj, M., Phillips, T.D. and Hayes, A.W. 1979. Effects of Mycotoxins on Hepatic Microsomal Monooxygenase Systems and Adenosine Triphosphatase Activity in Neonatal Rats. Presented at the 63rd Meeting of the Federation of American Societies for Experimental Biology, Dallas, Texas.

Phillips, T.D. and Hayes, A.W. 1979. Effects of Patulin and Pyran Derivatives on Transport and (Na^+ -K^+)-ATPase. Presented at the 1979 Meeting of the American Society for Pharmacology and Experimental Therapeutics, Portland, OR.

Hanna, G.D., Phillips, T.D., Cysewski, S.J., Kubena, L.F., Ivie, G.W., Heidelbaugh, N.D., Witzel, D.A. and Hayes, A.W. 1980. High Pressure Liquid Chromatographic Determination of Penicillic Acid Residues in Poultry. Federation Proc. 39:(3) 1102.

Schafer, R., Phillips, T.D. and Heidelbaugh, N.D. 1980. HPLC Detection of Hydroperoxides and Measurements of Their Toxic Effect on Transport Enzymes. Presented at the 1980 Meeting of the I.F.T., New Orleans, LA.

Kubena, L.F., Phillips, T.D., Witzel, D.A. and Heidelbaugh, N.D. 1980. Influence of Various Levels of Vanadium on Female Laying Strain Chickens. Presented at the Annual Meeting of the Poultry Science Association. Purdue University, W. Lafayette, IN.

Phillips, T.D., Hanna, G.D., Heidelbaugh, N.D. Cysewski, S.J., Kubena, L.F., Ivie, G.W. and Witzel, D.A. 1980. Detection of Penicillic Acid Residues in Poultry Utilizing High Pressure Liquid Chromatography. Presented at the Public Health Session of 1980 AVMA, Washington, D.C.

Heidelbaugh, N.D., Phillips, T.D., Hayes, A.W. and Steele, J.H. 1980. Mycotoxins: An Emerging Food Safety Issue. Presented at the Food and Water-Borne Disease - American Public Health Association Annual Meeting 4:10 p.m., Monday, October 20, Detroit, MI.

Phillips, T.D., Nechay, B.R., Kubena, L.F., Heidelbaugh, N.D., Shepherd, E.C., Stein, A.F., Neldon, S.L. and Witzel, D.A. 1981. Effects of Calcium Orthovanadate on Na^+-K^+ Adenosinetriphosphatase Activities in the Chicken. Toxicologist 1:(1), 119.

Phillips, T.D., Ivie, G.W., Heidelbaugh, N.D., Kubena, L.F., Cysewski, S.J. Hayes, A.W. and Witzel, D.A. 1981. High Pressure Liquid and Gas-Liquid Chromatographic Analysis of the Diazomethane Derivative of Penicillic Acid. Toxicologist 1:(1), 90.

Phillips, T.D., Stein, A.F., Ivie, G.W., Heidelbaugh, N.D. and Hayes, A.W. 1981. High Performance Liquid Chromatographic Analysis of a Diazomethane Reaction Product of Ochratoxin A and Its Application to Tissue Detection and Confirmation. Pharmacologist 23:(3), 115.

Phillips, T.D., Ivie, G.W., Heidelbaugh, N.D., Kubena, L.F., Cysewski, S.J. Hayes, A.W. and Witzel, D.A. 1981. Confirmation of Penicillic Acid by High Pressure Liquid and Gas-Liquid Chromatography. J. Assoc. Off. Anal. Chem. 64:(1),162-165.

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Educational background: B.S., Chemistry, University of Texas, Austin, 1964; Ph.D., Chemistry, University of Texas, Austin, 1971.

Work experience.

1973-present Assistant Toxicologist, Texas Veterinary Medical Diagnostic Laboratory, Department of Toxicology, Texas A&M University, College Station, TX
1972-1973 Research Associate, Clayton Foundation, Biochemical Institute, University of Texas, Austin, TX
1967-1971 Research Scientist, Clayton Foundation, Biochemical Institute, University of Texas, Austin, TX
1964-1967 Teaching Assistant, Department of Chemistry, University of Texas, Austin, TX

Area of research specialization. Toxicology and Analytical Chemistry.

Relevant publications (1975-present).

Ray, A.C., Norris, J.D., Jr. and Reagor, J.C. 1975. Benzene Hexachloride Poisoning in Cattle. JAVMA. 166:1180-1182.
Ray, A.C. and Eakin, R.E. 1975. Studies on the Biosynthesis of Aspergillin by Aspergillus niger. App. Micro.. 30:909-915.
Reagor, J.C. and Ray, A.C. 1975. The Identification of Plant Poisonings in Animals. Proceedings of Eighteenth Annual Meeting of American Association of Veterinary Laboratory Dignosticians. 433-444.
Reagor, J.C. and Ray, A.C. 1976. Cygon Poisoning in Cattle. Southwest. Vet. 29:247-248.
Ray, A.C., Dwyer, J.N. and Reagor, J.C. 1977. High Pressure Liquid Chromatographic Determination of Vitamin D_3 in Livestock Feed Supplements. J. Assoc. Off. Anal. Chem. 60:1296-1301.
Ray, A.C., Dwyer, J.N., Fambro, G.W. and Reagor, J.C. 1978. Clinical Signs and Chemical Confirmation of 4-Aminopyridine Poisoning in Horses. Am. J. Vet. Res. 39:329-331.
Ray, A.C., Tamulinas, S.H. and Reagor, J.C. 1978. Applications of High Performance Liquid Chromatography to Veterinary Toxicology, Proceedings of Twenty-first Annual Meeting of American Association of Veterinary Laboratory Diagnosticians. 185-194.
Ray, A.C., Reagor, J.C. and Robinson, R.M. 1978. Potential Use of Isoenzymes in Clinical Diagnosis, TVMAJ.

Ray, A.C., Tamulinas, S.H. and Reagor, J.C. 1979. High Pressure Liquid Chromatographic Determination of Cantharidin Using a Derivatization Method in Specimens from Animals Acutely Poisoned by Ingestion of Blister Beetles, Epicauta lemniscata. Am. J. Vet. Res. 40:498-504.

Gayle, L.G., Ray, A.C., Schwartz, W.L. and Gibbs, J.H. Case Report: Aflatoxicosis in Swine. Southwest. Vet. 33:112-113.

Ray, A.C., Post, L.O., Hurst, Edwards, W.C. and Reagor, J.C. 1980. Evaluation of an Analytical Method for the Diagnosis of Cantharidin Toxicosis Due to Ingestion of Blister Beetles (Epicauta lemniscata) by Horses and Sheep. Am. J. Vet. Res. 41:932-933.

Ray, A.C., Post, L.O. and Reagor, J.C. 1981. A High Pressure Liquid Chromatographic Method for the Determination of Sodium Fluoroacetate (Compound 1080) in Canine Gastric Content. J. Assoc. Off. Anal. Chem. 64:19-24.

Ray, A.C., Post, L.O., Hewlett, T.P. and Reagor, J.C. 1981. A Survey of Compounds Identified in a Veterinary Toxicology Laboratory Using GC/MS. Vet and Human Toxicology. (Accepted for publication).

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Work experience.

1969-present Head, Department of Toxicology in the Texas Veterinary Medical Diagnostic Laboratory, Texas A&M University, College Station, TX
1965-1969 Assistant Professor, Department of Agricultural Analytical Services and the Department of Biochemistry and Biophysics, Texas A&M University, College Station, TX

Area of research specialization. Toxicology, Animal Nutrition and Biochemistry

Relevant publications (1975-present).

Ray, A.C., Norris, J.D. and Reagor, J.C. 1975. Benzene Hexachloride Poisoning in Cattle. JAVMA. 166:1180-1182.
Reagor, J.D. and Ray, A.C. 1975. The Identification of Plant Poisonings in Animals. Proc. AAVLD. 433-441.
Dollahite, J.W., Rowe, L.D. and Reagor, J.C. 1975. Experimental Lead Poisoning in Horses and Spanish Goats. Southwest. Vet. 28:40-45.
Reagor, J.C. and Ray, A.C. 1976. Cygon^R Poisoning in Cattle. Southwest. Vet. 29:247-248.
Ray, A.C., Dwyer, J.N. and Reagor, J.C. 1977. High Pressure Liquid Chromatographic Determination of Vitamin D_3 in Livestock Feed Supplements. J. Assoc. Off. Anal. Chem. 60:1296-1301.
Ray, A.C., Dwyer, J.N., Fambro, G.W. and Reagor, J.C. 1978. Clinical Signs and Chemical Confirmation of 4-Aminopyridine Poisoning in Horses. Am. J. Vet. Res. 39:329-331.
Ray, A.C., Tamulinas, S.H. and Reagor, J.C. 1978. Applications of High Performance Liquid Chromatography to Veterinary Toxicology. Proc. AAVLD. 185-194.
Ray, A.C., Reagor, J.C., Robinson, R.M. 1978. Potential Use of Isoenzymes in Clinical Diagnosis. TVMAJ.
Ray, A.C., Tamulinas, S.H. and Reagor, J.C. 1979. High Pressure Liquid Chromatographic Determination of Cantharidin Using a Derivatization Method in Specimens from Animals Acutely Poisoned by Ingestion of Blister Beetles, Epicauta lemniscata. Am. J. Vet. Res. 40:498-504.

Ray, A.C., Post, L.O., Hurst, J.M., Edwards, W.C. and Reagor, J.C. 1980. Evaluation of an Analytical Method for the Diagnosis of Cantharidin Toxicosis Due to Ingestion of Blister Beetles (*Epicauta lemniscata*) by Horses and Sheep. Am. J. Vet. Res. 41:932-933.

Ray, A.C., Post, L.O. and Reagor, J.C. 1980. GC/MS Confirmation of Cantharidin Toxicosis due to Ingestion of Blister Beetles. Vet. and Human Toxicology. 22:398-399.

Ray, A.C., Post, L.O. and Reagor, J.C. 1981. A High Pressure Liquid Chromatographic Method for the Determination of Sodium Fluoroacetate (Compound 1080) in Canine Gastric Content. J. Assoc. Off. Anal. Chem. 64:19-24.

Ray, A.C., Post, L.O., Hewlett, T.P. and Reagor, J.C. 1981. A Survey of Compounds Identified in a Veterinary Toxicology Laboratory Using GC/MS. Vet. and Human Toxicology. (Accepted for publication).

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Work experience.

1981-Present Research Associate, Veterinary Physiology and Pharmacology, Texas A&M University, College Station, TX
1978-1981 Research Assistant, Department of Chemistry, University of Guelph, Guelph, Ontario Canada
1976-1978 Self-employed, Consultant work, Lake Nasser Nile Project, Cairo, Egypt;
Consultant, law firms in Western Michigan
Consultant, Dr. J.J.T.W.A. Strik of the Netherlands
Apr-Nov 1976 Consultant to the Michigan Senate Committee on Health, Social Services and Retirement

Area of research specialization. Biochemical Toxicology

Relevant publications (1975-present).

Parkinson, A., Robertson, L.W. and Safe, S. 1980. Further Characterization and Applications of the 4-Chlorobiphenyl Hydroxylase Assay In: Biologically Reactive Intermediates. (In press).
Parkinson, A., Robertson, L.W., Safe, L. and Safe, S. 1981. Polychlorinated Biphenyls as inducers of hepatic microsomal enzymes: Effects of di-ortho Substitution. Chem. Biol. Interact. 35:1-12.
Safe, S., Parkinson, A., Robertson, L.W., Cockerline, R, Safe, L., Bandiera, S. and Okey, A. 1981. PCBs as AHH Inducers In: Proceedings of the Workshop on the Impact of Chlorinated Dioxins and Related Compounds on the Environment (O. Hutzinger, ed.) Pergamon, Oxford. (In press).
Safe, S., Robertson, L.W., Parkinson, A., Shilling, M., Cockerline, R. and Campbell, M.A. 1981. Polybrominated Biphenyls, Polychlorinated Naphthalenes and Polychlorinated Terphenyls as Microsomal Enzyme Inducers. In: Halogenated Hydrocarbons: Health and Ecological Effects (M.A.Q. Khan, ed.) Pergamon, New York. (In press).
Safe, S., Parkinson, A., Robertson, L.W., Cockerline, R. and Safe, L. PCBs as Microsomal Enzyme Inducers: Structure-activity rules. In: Halogenated Hydrocarbons: Health and Ecological Effects (M.A.Q. Khan, ed.) Pergamon, New York. (In press).

Campbell, M.A., Bandiera, S., Robertson, L.W., Parkinson, A. and Safe, S. 1981. Octachloronaphthalene Induction of hepatic microsomal aryl hydrocarbon Hydroxylase activity in the immature male rat. Toxicol. (In press).

Robertson, L.W., Parkinson, A., Chittim, B., Bandiera, S., Fortier, T.S. and Safe, S. 1981. Aryl Hydrocarbon Hydroxylase (AHH) Induction and Toxicity of Polybrominated Biphenyls (PBBs): Enhancement by Photolysis. Toxicol. (In press).

Robertson, L.W., Parkinson, A., Bandiera, S. and Safe, S. 1981. Potent Induction of Rat Liver Microsomal, Drug Metabolizing, Enzymes by 2,3,3',4,4',5-hexabromobiphenyl, A Component of FireMaster. Chem. Biol. Interact. 35:13-24.

Parkinson, A., Robertson, L.W. and Safe, S. 1980. Hepatic Microsomal Enzyme Induction by 2,2',3,3',4,4',5-hexachlorobiphenyl. Life Sciences. 27: 2333-2337.

Robertson, L.W., Parkinson, A. and Safe, S. 1981. Induction of Drug-Metabolizing Enzymes by Fractionated Commercial Polybrominated Biphenyls (PBBs) Toxicol. Appl. Pharmacol. 57:254-262.

Parkinson, A., Robertson, L.W., Safe, L. and Safe, S. 1980. Polychlorinated Biphenyls as Inducers of Hepatic Microsomal Enzymes: Structure-Activity Rules. Chem. Biol. Interact. 30:271-285.

Parkinson, A, Cockerline, R., Robertson, L.W. and Safe, S. 1980. Induction of Cytochrome P-448 and P-450 by PCB Isomers and Congeners. In: Microsomes, Drug Oxidations and Chemical Carcinogenesis. 1:579-582. (Academic Press).

Parkisnon, A., Robertson, L.W. and Safe, S. 1980. Reconstituted Human Breast Milk PCBs as Potent Inducers of Aryl Hydrocarbon Hydroxylase (AHH). Biochem. Biophys. Res. Commun. 96:(2) 882-889.

Robertson, L.W., Parkinson, A. and Safe, S. 1980. Induction of Both Cytochromes P-450 and P-448 by 2,3',4,4',5-pentabromobiphenyl, A Component of FireMaster. Biochem. Biophys. Res. Commun. 92:(1) 175-182.

Strik, J.J.T.W.A., Doss, M., Schras, G., Robertson, L.W., von Tiepermann, R., and Harmsen, E.G.M. 1978. Coproporphyrinuria and Chronic Hepatic Porphyria Type A Found in Farm Families from Michigan (U.S.A.) Exposed to Polybrominated Biphenyls (PBB). In: Chemical Porphyria in Man. J.J. T.W.A. Strik and J.H. Koeman, eds. Elsevier/North Holland, Amsterdam.

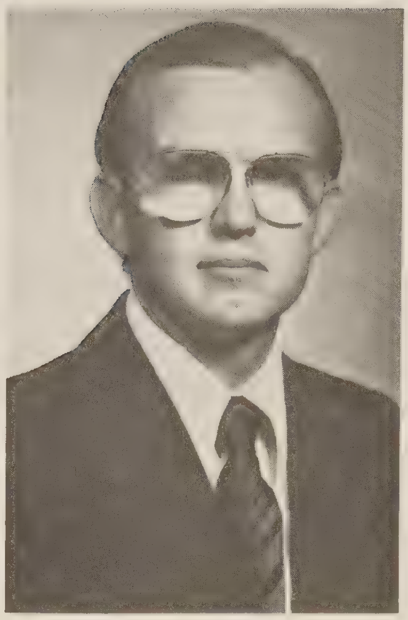
Robertson, L.W. 1976. PBB: Animal Health Effects. Michigan Veterinary Medical Association Newsletter.

Robertson, L.W. and Taaffe, G. 1976. Possible Effects of PBB on Humans. Michigan State Medical Society Journal. 75:562.

Robertson, and Taaffe, G. 1976. PBB - Human Health Effects? Michigan State Osteopathic Journal 41:37-39.

Robertson, and Chynoweth, D.P. 1975. Another Halogenated Hydrocarbon. Environment. 17:25-27.

LOYD D. ROWE



Veterinary Medical Officer
(Research Leader)
Veterinary Toxicology and Entomology
Research Laboratory
Agricultural Research Service
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Birthdate: August 10, 1943
Birthplace: Waco, Texas

Educational background. B.S., Pharmacy, University of Texas, 1966; B.S., Veterinary Science, Texas A&M University, 1968; D.V.M., Veterinary Medicine, Texas A&M University, 1969; M.S., Veterinary Toxicology, Texas A&M Universtiy, 1972.

Work experience.

1977-present Veterinary Medical Officer, ARS, USDA, College Station, TX
1976-1977 Veterinary Research Specialist, Dow Chemical U.S.A., Lake Jackson, TX
1975-1976 Practitioner, Zahn Pet Clinic, Fort Worth, TX
1973-1976 Assistant Professor, Veterinary Physiology and Pharmacology, Texas A&M University, College Station, TX
1970-1973 Instructor, Veterinary Physiology and Pharmacology, Texas A&M University, College Station, TX
1969-1970 Research Associate, Veterinary Physiology and Pharmacology, Texas A&M Universtiy, College Station, TX
1966-1969 Pharmacist (Community Practice), Bryan, Tx

Area of research specialization. Veterinary toxicology (natural products, environmental agents, agricultural chemicals, veterinary drugs); pharmacology.

Relevant publications (1975-present).

Dollahite, J. W., L. D. Rowe and J. C. Reagor. 1975. Experimental lead poisoning in horses and Spanish goats. Southwest. Vet. 28(1):40-45.
Kim, H. L., L. D. Rowe and B. J. Camp. 1975. Hymenoxon, a poisonous sesquiterpene lactone from Hymenoxys odorata DC. (bitterweed). Res. Commun. Chem. Pathol. 11(4):647-650.
Ivie, G. W., D. A. Witzel, W. Herz, R. Kannan, J. O. Norman, D. D. Rushing, J. H. Johnson, L. D. Rowe and J. A. Veech. 1975. Hymenovin. Major toxic constituent of western bitterweed (Hymenoxys odorata DC.). J. Agric. Food Chem. 23(5):841-845.
Rowe, L. D., H. L. Kim and B. J. Camp. 1980. The antagonistic effect of L-cysteine in experimental hymenoxon intoxication in sheep. Am. J. Vet. Res. 41(4):484-486.
Palmer, J. S., L. D. Rowe and H. R. Crookshank. 1980. Effect of age tolerance of calves to chlorpyrifos. Am. J. Vet. Res. 41(8):1323-1325.

Rowe, L. D., H. L. Kim and B. J. Camp. 1980. The antagonistic effect of L-cysteine in experimental hymenoxon intoxication in sheep. Am. J. Vet. Res. 41(4):484-486.

Palmer, J. S., L. D. Rowe and H. R. Crookshank. 1980. Effect of age on tolerance of calves to chlorpyrifos. Am. J. Vet. Res. 41(8):1323-1325.

Mollenhauer, H. H., L. D. Rowe, S. J. Cysewski and D. A. Witzel. 1981. Ultrastructural observations in ponies after treatment with Monensin. Am. J. Vet. Res. 42(1):35-40.

Mollenhauer, H. H., L. D. Rowe, S. J. Cysewski and D. A. Witzel. 1981. Ultrastructural observations in ponies after treatment with Monensin. Am. J. Vet. Res. 42(1):35-40.

Rowe, L. D. 1981. Crude Oils, Fuel Oils, and Kerosene, pp. 517-52 In Howard, J. L. (ed.). Current Veterinary Therapy--Food Animal. Practice, W. B. Saunders Company, Philadelphia, PA. 1233 pp.

2. Kim and D. J. [illegible]. 1990. [illegible]
in experimental [illegible]
(6):884-886.

L. O. Rowe and H. A. [illegible]. 1990. [illegible]
of calves to [illegible]. [illegible] Res. [illegible]

H., L. O. Rowe, S. J. [illegible] and D. A. [illegible]
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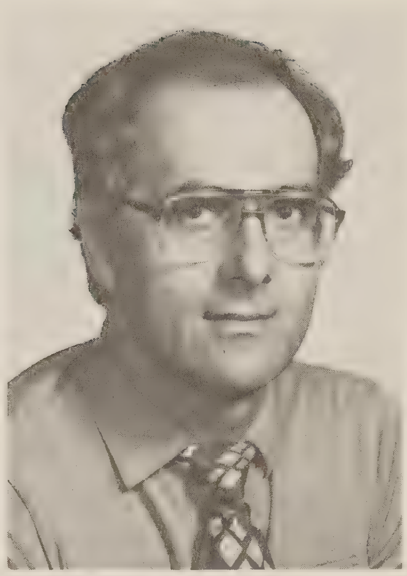
Res. 42(1):35-40.

D. H., L. O. Rowe, [illegible]
[illegible] observations [illegible] after [illegible]
Res. 42(1):35-40.

199[illegible]. Crude Oils, Fuel Oils, and [illegible]
[illegible]. Current Veterinary Therapy [illegible]
Company. Philadelphia, PA. [illegible]

STEPHEN H. SAFE



Professor
Veterinary Physiology and Pharmacology
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College Station, Texas

Birthdate: May 14, 1940
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Educational background: B.S., Chemistry, Queen's University, 1962; M.S., Chemistry, Queen's University, 1963, Ph.D., Chemistry, Oxford University, 1965.

Work experience.

1981-present Professor, Veterinary Physiology and Pharmacology, College of Veterinary Medicine, Texas A&M University, College Station, TX
1977-1981 Professor, Department of Chemistry, University of Guelph, Canada
1973-1977 Associate Professor, Department of Chemistry, University of Guelph, Canada
1968-1973 Research Officer, N.R.C. Atlantic Regional Laboratory
1967 Research Associate, Deptartment of Chemistry, Harvard University (K. Bloch)
1966 Research Assistant, Department of Chemistry, Oxford University, (Sir E.R.H. Jones)

Area of research specialization. Biochemical Toxicology and Pharmacology.

Relevant publications (1975-present).

Crawford, A. and Safe, S. 1977. An Assessment of the Effects of Enzyme Inducers on Aryl Hydrocarbon Hydroxylase Activity. Res. Commun. Chem. Pathol. and Pharmacol. 18:59-66.
Plugge, H. and Safe, S. 1977. The Metabolism of Vinyl Chloride: A Review. Chemosphere. 6:309-325.
Ecobichon, D.J., Hansell, M.M. and Safe, S. 1977. Halogen Substituents at the 4- and 4' Positions of Biphenyl: Influence on Hepatic Function in the Rat. Toxicol. Appl. Pharmacol. 42:359-366.
Wyndham, C. and Safe, S. 1978. The In Vitro Metabolism of 4-Chlorobiphenyl By Control and Induced Rat Liver Microsomes. Biochemistry. 17:208-215.
Kohli, J., Wyndham, C., Smylie, M. and Safe, S. 1978. The Metabolism of Bromobiphenyls. Biochem. Pharmacol. 27:1245-1249.
Sparling, J., Chittim, B., Clegg, B.S., Safe, S.H. and Crocker, J.F.S. 1978. The Tissue Distribution and Clearance of Aerotex 3470, An Aromatic Hydrocarbon Solvent. Chemosphere. 7:607-614.
Crocker, J., Digout, S., Bagnell, P., Lee, S., Rozee, K. and Safe, S. 1978. Viral Intera-tion with Pesticide Emulsifiers In Vivo. Chemosphere. 7:597-606.
Safe, S.H., Kohli, J. and Crawford, A. 1978. FireMaster BP-6: Fractionation, Metabolic and Enzyme Induction Studies. Environ. Health Perspect. 23:147-152.

Wyndham, C. and Safe, S.H. 1978. The Comparative In Vitro Metabolism of Biphenyl and 4-Chlorobiphenyl by Rat Liver Microsomes. J. Biochem. 56:993-997.

Hansell, M.M. and Safe, S.H. 1979. Isomerically Pure Bromobiphenyl Congeners and Hepatic Function in the Rat: Influence of Position and Degree of Bromination. Tox. Appl. Pharmacol. 47:341-352.

Crawford, A. and Safe, S.H. 1979. 4-Chlorobiphenyl Metabolism: The Effects of Chemical Inducers. Gen. Pharmacol. 10:227-231.

Wong, A., Basrur, P. and Safe, S.H. 1979. The Metabolically Mediated DNA Damage and Subsequent Repair by 4-Chlorobiphenyl in Chinese Hamster Ovary Cells. Res. Commun. Chem. Pathol. Pharmacol. 24:543-550.

Parkinson, A., Safe, S.H. 1979. The Detection of Enzyme Induction by Rat Liver Microsomes Prepared by Iso-electric Precipitation. J. Pharm. Pharmacol. 31:444-447.

Jones, D.H., Kohli, J. and Safe, S. 1979. Avian Metabolism of Halogenated Biphenyls. Xenobiotica. 9:733-736.

Parkinson, A., Safe, S.H. and Cockerline, R. 1980. Induction of Both 3-Methylcholanthrene and Phenobarbitone-Type Microsomal Enzyme Activity by a Single Polychlorinated Biphenyl Isomer. Biochem. Pharmacol. 29:259-262.

Robertson, L.W., Parkinson, A. and Safe, S.H. 1980. Induction of Both Cytochromes P-450 and P-448 by 2,3'4,4',5-Pentabromobiphenyl, A Component of FireMaster. Biochem. Biophys. Res. Commun. 92:175-182.

Parkinson, A., Copp, L. and Safe, S. 1980. 4-Chlorobiphenyl Hydroxylase Assay for Evaluating Microsomal Monooxygenase Activity. In Proceedings: Microsomes and Drug Oxidation, Academic Press, New York, 2:977-980.

Parkinson, A., Cockerline, L., Robertson, L. and Safe, S. 1980. The Induction of CytochromeP-448 and P-450 by PCB Isomers and Congeners. In Proceedings: Microsomes and Drug Oxidation, Academic Press, New York. 1:579-582.

Purdy, R. and Safe, S. 1980. The In Vitro Metabolism of 2,2',4,4',5,5'-Hexabromobiphenyl. J. Environ. Pathol. Toxicol. 4:277-284.

Parkinson, A., Copp, L. and Safe, S. 1980. A Comparison of the Benzo[a] Pyrene and 4-Chlorobiphenyl Hydroxylase Enzyme Assays in Distinguishing Between Phenobarbitone- and 3-Methylcholanthrene-Induced Microsomal Monooxygenases. Anal. Biochem. 105: 65-73.

Parkinson, A., Cockerline, R. and Safe, S. 1980. PCB Isomers and Congeners as Mixed-Type Inducers of Microsomal Monooxygenases. Chem. Biol. Interact. 29:277-289.

Sparling, J., Fung, D. and Safe, S. Bromo and Chlorobiphenyl Metabolism:GC-MS Identification of Urinary Metabolites and the Effects of Structure on their Rates of Excretion. Biomed. Mass Spectrom. 7:13-19.

Sparling, J., Safe, S. 1980. The Effects of Ortho Chloro Substituents on the Retention of PCB Isomers in Rat, Rabbit, Japanese Quail, Guinea Pig and Trout. Toxicol. Letters. 7: 23-28.

Sparling, J. and Safe, S. 1980. The Pharmakinetics of Five Hexachlorobiphenyl Isomers with Differ in their Degree of Ortho Substitution in the Rat. Chemosphere. 9:129-137.

Parkinson, A., Robertson, L. and Safe, S. 1980. Reconstituted Breast Milk PCBs as Potent Inducers of Aryl Hydrocarbon Hydroxylast (AHH). Biochem. Biophys. Res. Commun. 96:882-889.

Parkinson, A., Robertson, L. Safe, L. and Safe, S. 1980. Polychlorinated Biphenyls as Inducers of Hepatic Microsomal Enzymes: Structure-Activity Rules. Chem. Biol. Interact. 30: 271-285.

[illegible] Safe, S.H. 197[illegible]. The [illegible]
yl and 4-Chlorobiphenyl by [illegible]
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.M. and Safe, S.H. 1976. [illegible]
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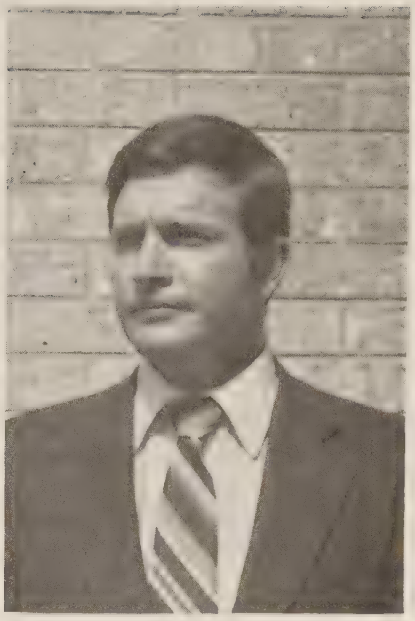
Interact. 29:277-289.
J., Fong, D. and [illegible], S. Bromo[illegible]
dentification [illegible]
their Rates of Excretion. [illegible]
Safe, S. 1980. The Effects [illegible]
ation of PCB Isomers in Rat [illegible]
Tox. Toxicol. Letters. [illegible]-28.
Safe, S. 1980. The [illegible] of [illegible]
s with Differ in their Degree of Ortho Substitutio[illegible]
phere. 9:129-137.
obertson, L. and Safe, S. 1980. Reconciliatio[illegible]
Potent Inducers of Aryl Hydrocarbon Hydroxylase [illegible]
ophys. [illegible] Commun. 96:382-389.
[illegible]son, [illegible] Safe, L. and Safe, S. 1980. Polychlori[illegible]
Inducers of Hepatic Microsomal Enzymes: Struct[illegible]
Biol. Interact. 30:271-285.

DARRELL N. UECKERT



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Range Science
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Educational background: B.S., Range Management, Texas Tech University, 1966; M.S., Range Science, Colorado State University, 1968; Ph.D., Range Science, Colorado State University, 1970.

Work experience.

1980-present Professor, Range Science, Texas Agricultural Experiment Station, San Angelo, TX
1976-1980 Associate Professor, Range Science, Texas Agricultural Experiment Station, San Angelo, TX
1973-1976 Associate Professor, Range and Wildlife Management Department, Texas Tech University, Lubbock, TX
1971-1973 Assistant Professor, Range and Wildlife Management Department, Texas Tech University, Lubbock, TX
1969-1971 Assistant Professor, Entomology Section, Texas Tech University, Lubbock, TX
1966-1969 N.D.E.A. Graduate Fellow, Range Science Department, Colorado State University
1966 Range Conservationist (G.S.7), Soil Conservation Service, United States Department of Agriculture
1958-1962 Farming and Ranching, Merkel, TX

Area of research specialization. Control, management and ecology of undesirable rangeland plants/Rangeland improvement/Ecology of rangeland insects.

Relevant publications (1975-present).

Meinzer, W.P., Ueckert, D.N. and Flinders, J.T. 1975. Food-niche of Coyotes in the Rolling Plains of Texas. J. Range Manage. 28:22-27.
Ueckert, D.N. 1975. Response of Honey Mesquite to Method of Top Removal. J. Range Manage. 28:(3) 233-234.
Bodine, M.C. and Ueckert, D.N. 1975. Effect of Desert Termites on Herbage and Litter in a Shortgrass Ecosystem in West Texas. J. Range Manage. 28:(5) 353-358.
Spears, B.M., Ueckert, D.N. and Whigham, T.L. 1975. Desert Termite Control in a Shortgrass Prairie: Effect on Soil Physical Properties. Environ. Entomol. 4:899-904.
Spears, B.M. and Ueckert, D.N. 1976. Survival and Consumption of the Desert Termite *Gnathamitermes tubiformans* in Relation to Dietary Nitrogen Source and Levels. Environ. Entomol. 5:(5) 1022-1025.

Ueckert, D.N., Bodine, M.C. and Spears, B.M. 1976. Population Density and Biomass of the Desert Termite Gnathamitermes tubiformans in a Shortgrass Prairie: Relationship to Temperature and Moisture. Ecology. 57:1273-1280.

Ueckert, D.N., Whigham, T.L. and Spears, B.M. 1978. Effect of Burning on Infiltration, Sediment, and other Soil Properties in a Mesquite-Tobosagrass Community. J. Range Manage. 31:420-425.

Ueckert, D.N., Smith, L.L. and Allen, B.L. 1979. Emergence and Survival of Honey Mesquite Seedlings on Several Soils in West Texas. J. Range Manage. 32:(4) 284-287.

Ueckert, D.N. 1979. Broom Snakeweed: Effect on Shortgrass Forage Production and Soil Water Depletion. J. Range Manage. 32:216-220.

Ueckert, D.N. 1979. Impact of a White Grub (Phyllophaga crinita) on a Shortgrass Community and Evaluation of Selected Rehabilitation Practices. J. Range Man-ge. 32:445-448.

Allen, C.T., Foster, D.E. and Ueckert, D.N. 1980. Seasonal Food Habits of A Desert Termite, Gnathamitermes tubiformans, in a Shortgrass Prairie in West Texas. Environ. Entomol. 9:461-466.

Ueckert, D.N., Scifres, C.J., Whisenant, S.G. and Mutz, J.L. 1980. Control of Bitterweed with Herbicides. J. Range Manage. 33:465-469.

Foster, D.E., Ueckert, D.N. and DeLoach, C.J. 1980. Insects Associated With Broom Snakeweed and Threadleaf Snakeweed in West Texas and Eastern New Mexico. J. Range Manage. (In press).

Muchiri, D.J., Bridges, C.H., Ueckert, D.N. and Bailey, E.M., Jr. 1980. Photosensitization of Sheep on Kleingrass Pasture. J. Amer. Vet. Med. Assoc. 177:(1) 353-354.

Whisenant, S.G. and Ueckert, D.N. 1981. Factors Influencing Bitterweed Seed Germination. J. Range Manage. (In press).

Whisenant, S.G. and Ueckert, D.N. 1981. Germination Response of Anisacanthus wrightii (Torr.) Gray (Acanthaceae) to Selected Environmental Variables. Southwest. Nat. 26:(4) (In press).

Whisenant, S.G. and Ueckert, D.N. 1981. Germination Response of Eysenhardtia texana and Leucaena retusa. J. Range Manage. (In press).

Calhoun, M.C., Ueckert, D.N., Livingston, C.W., Jr. and Baldwin, B.C., Jr. 1981. Association Between Bitterweed Dose, Voluntary Feed Intake and Some Blood Serum Constituents of Sheep. Amer. J. Vet. Research. (In press).

Calhoun, M.C., Ueckert, D.N., Livingston, C.W.,Jr. and Camp, B.J. 1981. Effect of 2,4-D on Hymenoxon Concentration and Toxicity of Bitterweed Force-Fed to Sheep. J. Range Manage. (In press).

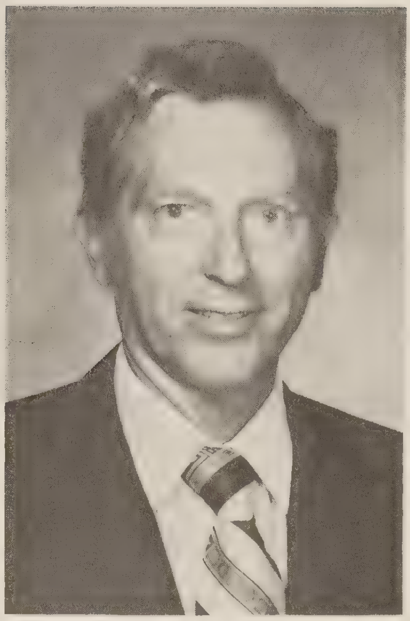
Ueckert, D.N. and Whisenant, S.G. 1981. Individual Plant Treatments for Controlling Redberry Juniper Seedlings. J. Range Manage. (In press).

Freeman, M.R., Ueckert, D.N. and Nelson, J.T. 1982. Herbicidal Control of Woolly Locoweed. J. Range Manage. (In review).

Ueckert, D.N., Jacoby, P.W., Jr. and Hartmann, S. 1982. Tarbush Control with Tebuthiuron. J. Range Manage. (In review).

Jacoby, P.W. and Ueckert, D.N. 1982. Control of Creosotebush (Larrea tridentata) with Pelleted Herbicides in Eastern Chihuahuan Desert. J. Range Manage. (In review).

M. COBURN WILLIAMS



Research Plant Physiologist
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Educational background. B.S., Agricultural Education, Kansas State University, 1951; M.S., Agronomy, Kansas State University, 1951; Ph.D., Agronomy, University of Illinois, 1956.

Work experience.

1956-present Poisonous Plant Research Laboratory, ARS, USDA, Logan, UT

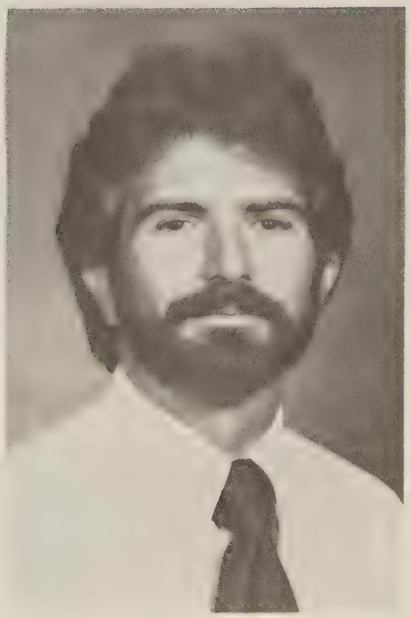
Area of research specialization. Physiology, biochemistry, and control of poisonous range weeds.

Relevant publications (1975-present).

Williams, M. C. and L. F. James. 1975. Toxicity of nitro-containing *Astragalus* to sheep and chicks. J. Range Mangement 28:260-263.
Williams, M. C., F. R. Stermitz and R. D. Thomas. 1975. Nitro compounds in *Astragalus* species. Phytochemistry 14:2305-2306.
Stermitz, F. R., R. D. Thomas and M. C. Williams. 1975. Furocoumarins in *Cymopterus watsonii*. Phytochemistry 14:1681.
Williams, M. C., L. F. James and A. T. Bleak. 1976. Toxicity of introduced nitro-containing *Astragalus* to sheep, cattle, and chicks. J. Range Management 29:30-33.
Williams, M. C. and L. F. James. 1976. Poisoning in sheep from Emory milkvetch and nitro compounds. J. Range Management 29:165-167.
James, L. F., M. C. Williams and A. T. Bleak. 1976. Toxicity of *Bassia hyssopifolia* to sheep. J. Range Management 29:284-285.
Williams, M. C., G. S. Yost and F. R. Stermitz. 1977. Miserotoxin, a toxic compound in *Astragalus michauxii*. Phytochemistry 16:1438-1439.
Yost, G. S., F. R. Stermitz and M. C. Williams. 1977. Toxic furocoumarins of *Cymopterus longipes*. Phytochemistry 16:1097.
Williams, M. C. and R. C. Barneby. 1977. The occurrence of nitro-toxins in North America *Astragalus* (Fabaceae). Brittonia 29:310-326.
Williams, M. C. and R. C. Barneby. 1977. The occurrence of nitro-toxins in Old World and South American *Astragalus* (Fabaceae). Brittonia 29:327-331.
Egyed, M. N. and M. C. Williams. 1977. Photosensitizing effects of *Cymopterus watsonii* and *C. longipes* in chickens and turkey poults. Avian Diseases 21:566-575.

Williams, M. C. 1978. Toxicity of saponins in alfombrilla (Drymaria arenarioides). J. Range Management 31:182-184.
Williams, M. C. and L. F. James. 1978. Livestock Poisoning from Nitro-bearing Astragalus, pp. 379-389. In R. F. Keeler, K. R. Van Kampen and L. F. James (eds.). Effects of Poisonous Plants on Livestock. Academic Press, New York.
Williams, M. C. 1979. Toxicological investigations on Galenia pubescens. Weed Sci. 27:506-508.
Williams, M. C., L. F. James and B. O. Bond. 1979. Emory milkvetch (Astragalus emoryanus var. emoryanus) poisoning in chicks, sheep, and cattle. Am. J. Vet. Res. 40:403-406.
Williams, M. C. and L. C. Fierro. 1980. Seasonal concentration and toxicity of saponins in alfombrilla. J. Range Management 33:157-158.
James, L. F., W. J. Hartley, M. C. Williams and K. R. Van Kampen. 1980. Field and experimental studies in cattle and sheep poisoned by nitro-bearing Astragalus or their toxins. Am. J. Vet. Res. 41:377-382.
James, L. F., R. F. Keeler, A. E. Johnson, M. C. Williams, E. H. Cronin and J. D. Olsen. 1980. Plants poisonous to livestock in the western states. Agr. Infor. Bull. 415. 90 pp.
Williams, M. C. 1980. Purposefully introduced plants that have become noxious or poisonous weeds. Weed Sci. 28:300-305.
Williams, M. C. 1980. Toxicological investigations on Astragalus hamosus and Astragalus sesameus. Australian J. of Experimental Agriculture and Animal Husbandry 20:162-165.
Williams, M. C. and E. H. Cronin. 1981. Ten-year control of western false hellebore (Veratrum californicum Durand). Weed Sci. 29:22-23.
Cronin, E. H., M. C. Williams and J. D. Olsen. 1981. Toxicity and control of Kelsey milkvetch. J. Range Management 34:181-183.
Williams, M. C. 1981. Nitro compounds in Indigofera species. Agronomy J. 73:434-436.
Williams, M. C. 1981. Nitro compounds in foreign species of Astragalus. Weed Sci. 29:261-269.

RICHARD D. WILSON



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Educational background. B.S., Zoology, Texas A&M University, 1974; Ph.D., Veterinary Toxicology, Texas A&M University, 1979.

Work experience.

1980-present Research Physiologist, Veterinary Toxicology, ARS, USDA, College Station, TX
1973-1979 Student Worker, ARS, USDA, College Station, TX

Area of research specialization. Neurotoxicology (electrophysiology).

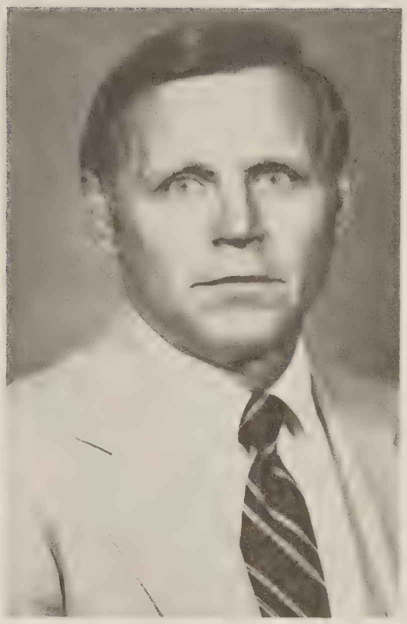
Relevant publications (1975-present).

Witzel, D. A., E. L. Smith, R. D. Wilson and G. D. Aguirre. 1978. Congenital stationary night blindness: An animal model. Investigative Ophthalmology & Visual Science 17(8):788-795.

Wilson, R. D. 1980. Electrophysiological assessment of delayed neurotoxicity in sheep treated with haloxon. Dissert. Abstr. International 40(8):3613-B.

Ziprin, R. L., M. H. Elissalde, D. E. Clark and R. D. Wilson. 1980. Absorption of polychlorinated biphenyl by the ovine lymphatic system. Vet. Hum. Toxicol. 22(5):305-308.

DONALD A. WITZEL



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1961-1972 Veterinary Medical Officer, National Animal Disease Center, ARS, USDA, Ames, IA
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Relevant publications (1975-present).

Witzel, D. A., Johnson, J. H. and Younger, R. L. 1975. Partial lobectomy of bovine liver: A new biopsy technique. Cornell Vet. 65(1):112-115.
Johnson, J. H., Younger, R. L., Witzel, D. A. and Radeleff, R. D. 1975. Acute toxicity of tricyclohexyltin hydroxide to livestock. Toxicol. Appl. Pharmacol. 31(1):66-77.
Ivie, G. W., Witzel, D. A., Herz, W., Kannan, R., Norman, J. O., Rushing, D. D., Johnson, J. H., Rowe, L. D. and Veech, J. A. 1975. Hymenovin, major toxic constituent of western bitterweed (*Hymenoxys odorata* DC.) J. Agric. Food Chem. 23(5):841-845.
Ivie, G. W., Witzel, D. A. and Rushing, D. D. 1975. Toxicity and milk bittering properties of tenulin, the major sesquiterpene lactone constituent of *Helenium amarum* (bitter sneezeweed). J. Agric. Food Chem. 23(5):845-849.
Ivie, G. W., Bull, D. L. and Witzel, D. A. 1976. Metabolic fate of O-ethyl O-[4-(methylthio)phenyl-^{14}C]S-propyl phosphorodithioate (BAY NTN 9306) in a lactating cow. J. Agric. Food Chem. 24(1):147-151. 1976.

Witzel, D. A. and Smith, E. L. 1976. Electroretinography, pp. 365-390. In Klemm, W. R. (ed.) Applied Electronics for Veterinary Medicine and Animal Physiology, Charles C. Thomas, Springfield. 466 pp.

Witzel, D. A., Smith, E. L., Beerwinkle, K. R. and Johnson, J. H. 1976. Arsanilic acid-induced blindness in swine: Electroretinographic and visually evoked responses. Am. J. Vet. Res. 37(5):521-524.

Witzel, D. A., Ivie, G. W. and Dollahite, J. W. 1976. Mammalian toxicity of helanalin, the toxic principle of Helenium microcephalum DC. (small-head sneezeweed). Am. J. Vet. Res. 37(7):859-861.

Witzel, D. A., Johnson, J. H., Pitts, D. G. and Smith, E. L. 1976. Schleral contact lens electrodes for electro-retinography in domesticated animals. Am. J. Vet. Res. 37(8):983-985.

Ivie, G. W., Witzel, D. A., Herz, W., Sharma, R. P. and Johnson, A. E. 1976. Isolation of hymenovin from Hymenoxys richardsonii (pingue) and Dugaldia hoopesii (orange sneezeweed). J. Agric. Food Chem. 24(3):681-682.

Smith, E. L., Witzel, D. A. and Pitts, D. G. 1976. The waveform and scotopic CFF of the sheep electroretinogram. Vision Res. 16:1241-1245.

Steel, E. G., Witzel, D. A. and Blanks, A. 1976. Acquired coagulation factor X activity deficiency connected with Hymenoxys odorata DC. (compositae) bitterweed poisoning in sheep. Am. J. Vet. Res. 37(12):1383-1386.

Beerwinkle, K. R. and Witzel, D. A. 1976. A pneumatically-driven, electronically controlled respirator for use with large animal inhalation anesthesia systems. Vet. Anesthesia 3(2):110-115.

Witzel, D. A., Jones, L. P. and Ivie, G. W. 1977. Pathology of subacute bitterweed (Hymenoxys odorata) poisoning in sheep. Vet. Pathol. 14:73-78.

Witzel, D. A., Joyce, J. R. and Smith, E. L. 1977. Electroretinography of congenital night blindness in an appaloosa filly. J. Equine Med. Surg. 1(6):226-229.

Ziprin, R. L., Fowler, S. R. and Witzel, D. A. 1977. Alveolar macrophage lymphocyte rosette formation: Failure of levamisole to alter activity. Poult. Sci. 16(2):720-722.

Witzel, D. A., Riis, R. C., Rebhun, W. C. and Hillman, R. B. 1977. Night blindness in the appaloosa: Sibling occurrence. J. Equine Med. Surg. 1(11):383-386.

Witzel, D. A., Dollahite, J. W. and Jones, L. P. 1978. Photosensitization in sheep fed Amni majus (bishop's weed) seed. Am. J. Vet. Res. 39(2):319-320.

Witzel, D. A., Springer, M. D. and Mollenhauer, H. H. 1978. Cone and rod photoreceptors in the white-tailed deer (Odocoileus virginianus). Am. J. Vet. Res. 39(4):699-701.

Witzel, D. A., Smith, E. L., Wilson, R. D. and Aguirre, G. D. 1978. Congenital stationary night blindness: An animal model. Invest. Ophthalmol. Vis. Sci. 17(8):7880795.

Cysewski, S. J., Witzel, D. A., Reagor, J. C. and Rowe, L. D. 1979. A syndrome of delayed neurotoxicity in angora goats. J. Am. Vet. Med. Assoc. 175(6):608.

Phillips, T. D., Ivie, G. W., Heidelbaugh, N. D., Kubena, L. F., Cysewski, S. J., Hayes, A. W. and Witzel, D. A. 1980. Confirmatory test for the mycotoxin penicillic acid utilizing high pressure liquid and gas liquid chromatographic analysis. J. Assoc. Off. Anal. Chem. 64(1):441-443.

Mollenhauer, H. H., Rowe, L. D., Cysewski, S. J. and Witzel, D. A. 1981. Ultrastructural observations in ponies after treatment with monensin. Am. J. Vet. Res. 42(1):35-40.

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Area of research specialization. 1) Immunobiology: comparative immunology, ontogeny of the immune response, and macrophage physiology; 2) Microbial physiology: pathogenic mechanisms (microbial toxins & virulence); and 3) Food microbiology: enterotoxins and fermentations.

Relevant publications (1975-present).

Ziprin, R. L. and E. L. Jeska. 1975. Humoral factors affecting mouse peritoneal cell adherence reactions to *Ascaris suum*. Infect. Immun. 12(3):499-504.
Ziprin, R. L. and S. R. Fowler. 1977. Rosette-forming ability of alveolar macrophages from rat lung: Inhibition by hexachlorobenzene. Toxicol. Appl. Pharmacol. 39:105-109.
Ziprin, R. L., S. R. Fowler and D. A. Witzel. 1977. Alveolar macrophage-lymphocyte rosette formation: Failure of levamisole to alter activity. Infect. Immun. 16(2):720-722.
Thompson, J. M., S. M. Meola, R. L. Ziprin and E. L. Jeska. 1977. An ultrastructural study of the invasion of *Ascaris suum* larvae by neutrophils. J. Invertebr. Pathol. 30:181-184.
Ziprin, R. L. 1978. Phagocytosis by sheep alveolar macrophages: Relationship between Opsonin concentration and light emission in the presence of luminol. Infect. Immun. 19(3):396-397.

Ziprin, R. L. 1978. Immune response of the greater wax moth, Galleria mellonella, induced by the marine pseudomonad, B-16. J. Invertebr. Pathol. 32(3):396-397.

Greenblatt, G. A. and R. L. Ziprin. 1979. Endotoxin-induced histamine hypersensitivity in mice. A model system for byssinosis? Am. Ind. Hyg. Assoc. J. 40:74-77.

Greenblatt, G. A. and R. L. Ziprin. 1979. Inhibition of luminol-dependent chemiluminescence of alveolar macrophages by possible etiological agents of byssinosis. Am. Ind. Hyg. Assoc. J. 40:860-865.

DeVaney, J. A and R. L. Ziprin. 1980. Detection and correlation of immune responses in white leghorn chickens to northern fowl mite, Ornithonyssus sylviarum (Canestrini and Fanzago). Poul. Sci. 59:34-37.

DeVaney, J. A. and R. L. Ziprin. 1980. A demonstration of acquired immune responses in white leghorn hens to northern fowl mite, Ornithonyssus sylviarum (Canestrini and Fanzago) populations. Poul. Sci. 59:1743-1744.

Ziprin, R. L., E. G. Steel, H. D. Petersen, M. H. Elissalde and M. McCartor. 1980. Hematological study of effects of levamisole on stressed cattle. Am. J. Vet. Res. 41(11):1883-1884.

Elissalde, M. H., G. A. Greenblatt and R. L. Ziprin. 1980. The role of prostaglandin $F_{2\alpha}$ in byssinosis. Am. Ind. Hyg. Assoc. J. 41:382-384.

Ziprin, R. L., M. H. Elissalde, D. E. Clark and R. D. Wilson. 1980. Absorption of polychlorinated biphenyl via the ovine lymphatic system. Vet. Human Tox. 22(5):305-308.

Fowler, S. R., R. L. Ziprin, M. H. Elissalde and G. A. Greenblatt. 1981. The etiology of byssinosis--Possible role of prostaglandin $F_{2\alpha}$ synthesis by alveolar macrophages. Am. Ind. Hyg. Assoc. J. 42:445-448.

n, R. L. 1978. Immune responses of the [illegible] moth, Galleria mellonella, induced by the marine [illegible], B-21. J. Invertebr. Pathol. 32(3):396-397.
[illegible], G. A. and R. L. Ziprin. 1979. Endotoxin-induced histamine hypersensitivity in mice. A model system for byssinosis? Am. Ind. Hyg. Assoc. J. 40:74-77.
olatz, G. A. and R. L. Ziprin. 1980. Inhibition of luminol-dependent chemiluminescence of alveolar macrophages by possible etiological agents of byssinosis. Am. Ind. Hyg. Assoc. J. [illegible]
y, J. A and R. L. Ziprin. 1980. Detection and correlation of immune responses in white leghorn chickens to northern fowl mite, Ornithonyssus sylviarum (Canestrini and Fanzago). Poult. Sci. 59:[illegible]
r, J. A. and R. L. Ziprin. 1980. A demonstration of acquired immune responses in white leghorn hens to northern fowl mite, Ornithonyssus sylviarum (Canestrini and Fanzago) populations. Poult. Sci. 59:[illegible]
n, R. L., E. G. Steel, H. D. Petersen, M. H. Elissalde and R. McCarthy. 1980. Hematological study of effects of levamisole on stressed cattle. Am. J. Vet. Res. 41(11):[illegible]-1884.
salde, M. H., G. A. Greenblatt and R. L. Ziprin. 1982. The role of prostaglandin F_2 in byssinosis. Am. Ind. Hyg. Assoc. J. 43:[illegible]
n, R. L., M. H. Elissalde, G. C. Clark and H. D. Villaon. 1980. Absorption of polychlorinated biphenyl via the mouse lymphatic system. Vet. Human Tox. 22(5):305-306.
er, S. K., R. L. Ziprin, M. H. Elissalde and G. A. Greenblatt. 1981. The etiology of byssinosis--Possible role of prostaglandin F_2 synthesis by alveolar macrophages. Am. Ind. Hyg. Assoc. J. 42:[illegible]